JULY 3, 1937

ELECTRICAL WORLD

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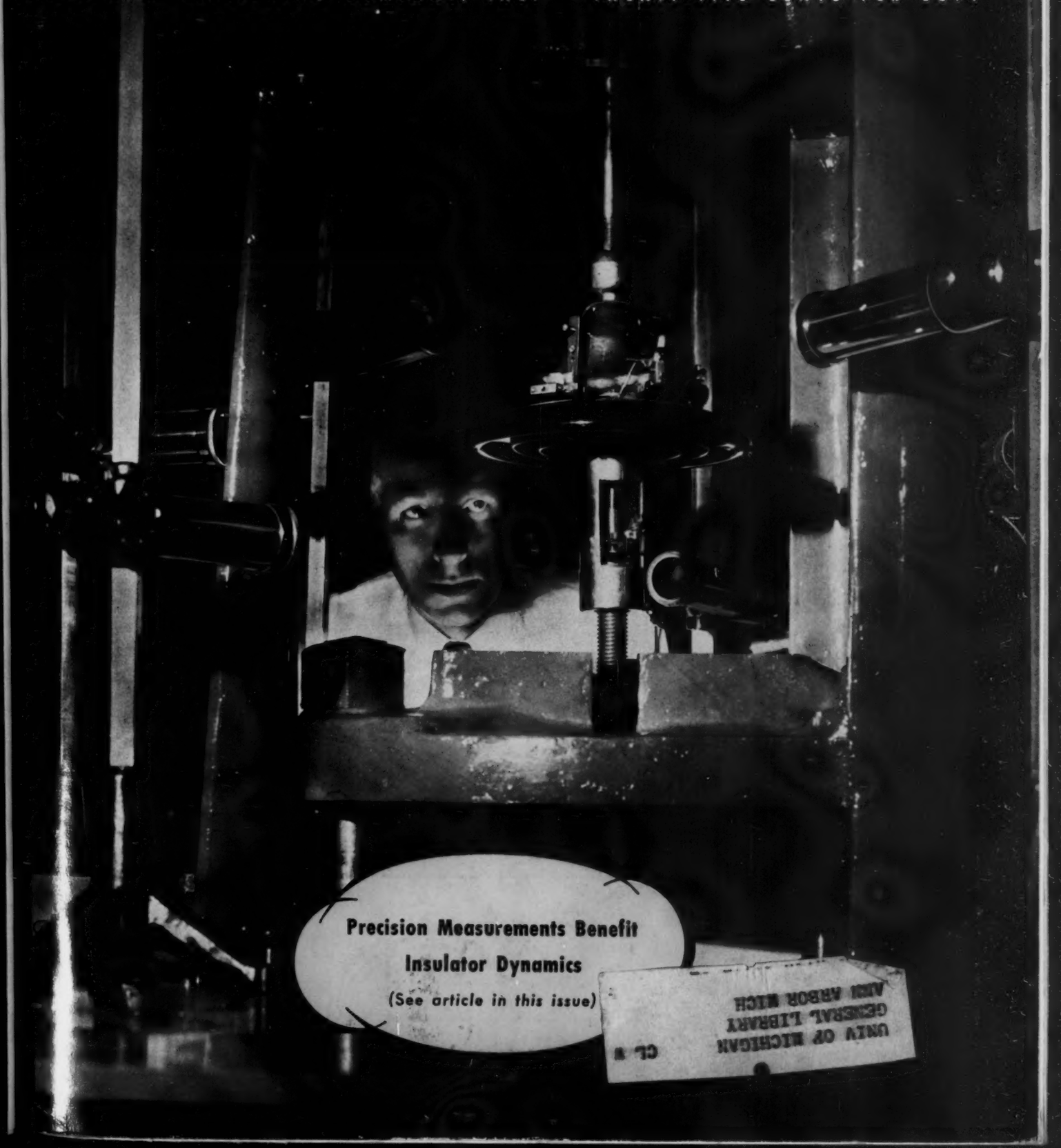

Precision Measurements Benefit Insulator Dynamics

(See article in this issue)

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Coming Features

Lighting as a Load Builder

In a special insert, scheduled for July 31, ELECTRICAL WORLD presents an evaluation of lighting as a load builder. Consideration will be given to residential, commercial, industrial, highway and rural markets. Several case studies will be presented.

Electric Heat Treating Improves Product

A small tool manufacturer reports to the Hartford Electric Light Company that electric heat treatment has improved its product—drill chucks—reduced the number of rejects and saved production time, all with costs no higher than when fuel-fired furnaces were used. Read about it in the July 17 issue.

Pasadena Analyzes Gains from Frequency Change

Analysis of the gains made by Pasadena's Municipal Plant in its frequency change-over from 50 to 60 cycles shows that distribution savings alone would have justified the change. An early article points out other gains.

On the Cover

Louis A. Meisse, co-author of an article in this issue on insulator dynamics, makes precision measurements on a suspension insulator with optical strain gages.

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Letters TO THE EDITOR

How Many Employees?

To the Editor of ELECTRICAL WORLD:

The various annual statistical issues of Electrical World beginning with the issue of January 7, 1928, (page 32), contain data on employment in the Electric Light and Power Industry, covering the period 1926 to date. The editors indicate that the data for the intercensal years after 1928 were estimated on the basis of "index numbers announced by the Bureau of Labor Statistics for non-census years." (Electrical World, January 4, 1936, p. 61), but we were unable to find mention of the method used in estimating employment prior to 1929.

We are making a study of the Electric Light and Power Industry in connection with which we are anxious to secure data on the number wage earners and the number of salaried employees in the industry in each year from 1920 to date. We would therefore like to know the details of your method of estimating employment, whether you have available the breakdowns of employment into wage earners and salaried workers, and whether you have made any estimate of employment in the industry for the years prior to 1926.

HARRY MAGDOFF
Senior Statistician
Works Progress Administration
Philadelphia, Pa.

[Original sources of information on employment are the quinquennial Census of Electrical Industry and the Bureau of Labor Statistics "monthly index for electric light and power and manufactured gas."

Totals for non-census years were based on the assumption that the Labor Bureau Index, which really refers only to wage earners, measured the changes in totals with sufficient accuracy for our purpose, which was primarily to show the approximate magnitude of the industry as an employer and the relatively high degree of stability of employment, the estimates for the past eight years ranging between 298,000 as a maximum and 232,000 as a minimum.

It will be seen from this that no breakdown could be made as to wage earners and salaried employees in intercensal years.

Because of the time-lag in publication of the results of the 1927 census, an authoritative figure for that year could not be incorporated by us in statistical issues prior to that of January 4, 1930. —THE EDITORS]

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Book Treats Co-ordination

To the Editor of ELECTRICAL WORLD:

The letter of C. L. Young of the West Texas Utilities Company in your issue of May 22 refers to *inductive co-ordination* problems and the division of cost of corrective measures. Your reply mentions the detailed reports of the joint studies conducted by the E.E.I. and the Bell System on the first subject. The book, "Inductive Co-ordination," review in your issue of September 12, 1936, was intended as a concise summary of the inductive principles, relations between circuits and methods of mitigation, and has proved helpful to many.

The division of cost, as you state, has been the subject of considerable study, some state commissions having laid down general principles to apply. Usually, however, the solution is a compromise involving principles of economics, equity and public relations.

L. J. CORBETT.
Berkeley, Calif.

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First Canadian Trolley Buses

To the Editor of the ELECTRICAL WORLD:

I would suggest you check the accuracy of the statement in the article "Trackless Trolleys," which appeared in the ELECTRICAL WORLD April 24. I know that the Toronto Transportation Commission was operating trackless trolley buses about twelve (certainly over ten) years ago, because I frequently rode in them. I believe, though I am not absolutely sure on this point, that trackless trolleys were operated in the city of Windsor, Ont., as long as ten years ago.

PERRY A. BORDEN.

[The item referred to a fleet of seven trolley buses recently arrived in Montreal as the first in Canada. Our correspondent is right that trackless trolley cars had previously operated in Toronto, but after a short period they were withdrawn. The trolley bus is different from the trackless trolley car. The latter was but a makeshift. The trolley bus which came in around 1928, is entirely different from the trolley car in design and operation. The item as printed, therefore, was correct.—EDITORS.]

•

Questions Meter Coding

To the Editor of ELECTRICAL WORLD:

On page 54 of the March 13 issue of ELECTRICAL WORLD appears an article regarding an identifying code for meters. It is claimed that such a system tends to speed and accuracy and saves labor in record keeping and references to meters. Personally, I am of the opinion that such a code does just the opposite.

I will concede the fact that it requires less time to use a code than a full description of a meter, but it has been my observation that a very shortened method of describing a meter is usually used by the men handling the meter. For example, a 5-amp., 110-volt, two-wire General Electric type I-14 meter is referred to as a 5-11-I-14. This is not very much longer than the code 11X. When you get into the more complex meters the difference would still remain the same.

By using the actual identification as given by the manufacturer, the metermen and clerks do not have to memorize a lengthy code. I use the term "lengthy" advisedly, as the article gives a code showing sixty-six different things one must know, with a number of qualifying letters and figures to use with the same. Also, the meter types listed are limited to the most common. It would seem in this respect that errors would be more likely to occur using the code, especially in the case of new help or where one finds its necessary to refer to meters infrequently.

Another matter would be the coding of such other instruments as current or potential transformers, time switches, demand instruments, etc. This would very materially increase the size of the code required and thus make it more difficult.

Complete technical data when wanted can be obtained from the index card, which has a complete record of the meter. In the majority of cases where data on a particular meter is required the customer's name or address is necessary, so reference would have to be made to the card even though a code were in use.

The use of a code with its various identifying letters and digits would be confusing for use where the utility company's serial number is the control for properly matching ledger, billing records and bills. The billing machine we use could not use a code as suggested, as the letters and digits are not interchangeable such as an SP to be followed with the next one, Y2.

While each utility should use the methods and systems best adapted to its own needs, I believe that the simplest and easiest way to do any task is the best way, and therefore see no real advantage in a coding system for meters.

C. W. NULL,
Detroit Edison Company.

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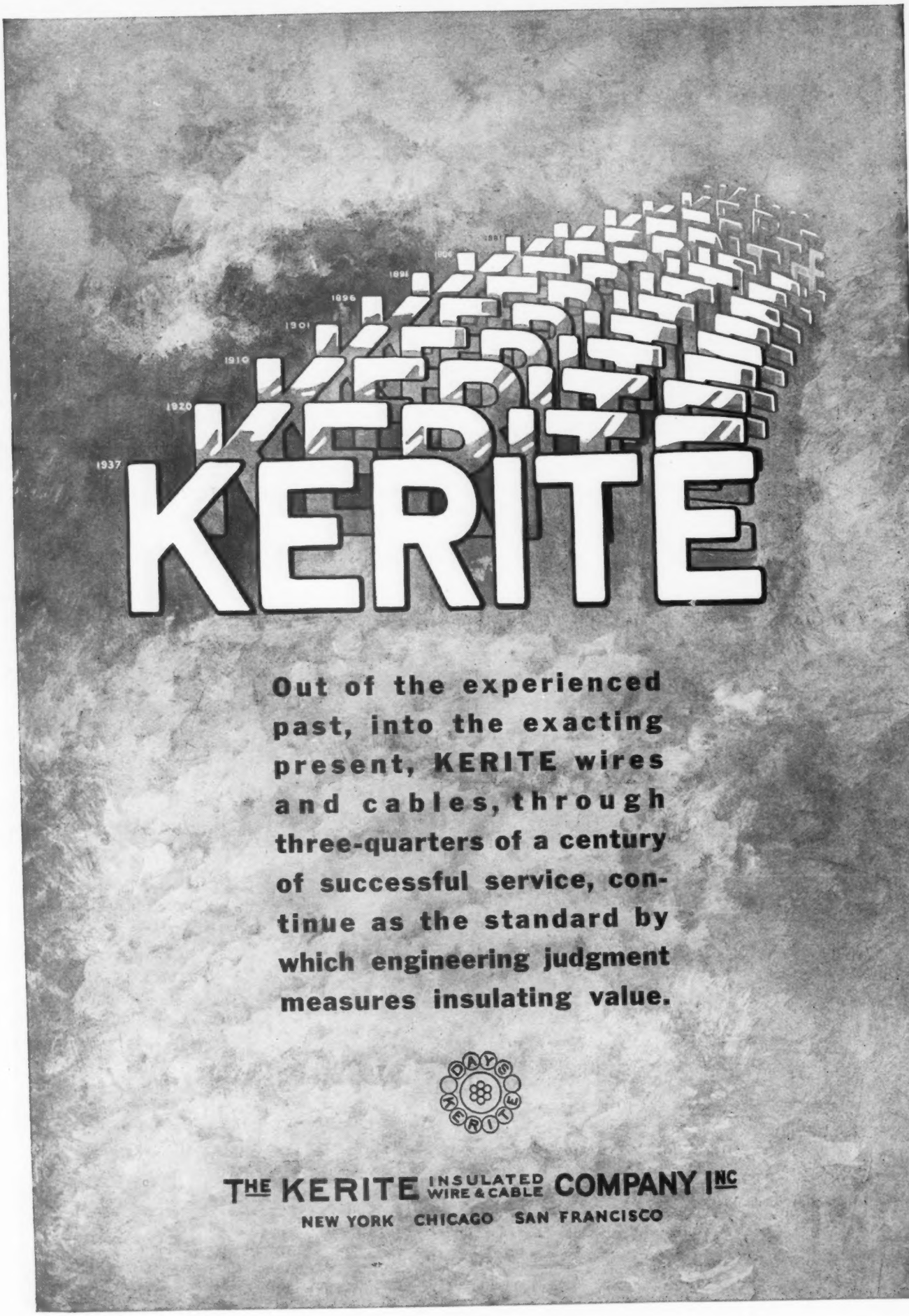
No 1935 Supplement Published

The following is typical of several letters that have been recently received.

To the Editor of ELECTRICAL WORLD:

Kindly send us two copies of the Supplement of the ELECTRICAL WORLD published in 1935 for the year 1934.

[We regret that we have been unable to comply with these requests. Publication of the Supplement was omitted in the year in question. A few copies of issues previously published are still available for sale to readers who wish to round out broken files. —THE EDITORS]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ELECTRICAL WORLD

JULY 3, 1937

Load Building to Measure Investment Value

There are so many threats today—tax, regulatory, political and competitive—against the public utility business that large purchasers of securities are beginning to broaden the basis for measuring their security values in much the same way as industrial investment values are judged.

The plant and system may be modern and in first-class shape. The engineering may be of the best. The earnings may at the moment be excellent. But what is the company doing to insure its continuance as a profitable venture? And so we have the reason why certain insurance companies with large power company holdings are investigating the non-physical aspects of utilities in which they have a financial interest.

In what way is new business promoted, they want to know, and at what cost? What are the customer relations?

After all, the investor is interested in the net. He sees taxes, wages and other costs mounting sharply, while the average rate for energy continues to come down. Obviously the answer is more revenue in the higher-net brackets. Of course, it isn't as simple as that, for before profitable load can be developed it is necessary to know what the load possibilities are and what is the cost of securing the load. This means market surveys to determine consumption potentials, balanced load growth and co-ordination of load and system planning. In many companies it will mean an entirely new conception of the function of the commercial departments. It means that merchandise sales and kilowatt-hour sales are but a means to an end—net revenue.

The investor also wants to know the history of the company's rates and what customers think of the company. If, for any reason, customer relations are strained, there is fertile soil for a municipal ownership agitation, and that is not very attractive to security holders.

The electric utilities are going to want considerable new money before long to finance the new additions that are being required by the rapid increase in output. This money will be needed not only in large volume but at low rates. Naturally the rate for this money is going to depend upon the security offered, and that to a large degree will be determined by the non-physical assets. Investors can no longer ignore the possibility of municipal ownership, or of an agitation for drastic rate cuts. A company that has not reduced its rates in keeping with the trend presents a less desirable picture to the investor.

Some companies have started on a program of market research which will be the basis for future load-building activities. How many companies, however, have reached the position of being able to predetermine the cost per dollar of E.A.R. that will be reasonable and profitable? How many companies know how much non-recurrent expense can be profitably allowed to secure a dollar of recurrent revenue?

The companies that spend money now to get the facts about their market and to know how much to spend to develop load may find that instead of being an expense it was a most profitable investment because of the lower price of money they may be able to command in future financing.

BETTER LIGHT—BETTER SIGHT—BETTER WORK

The eighteen girls who sort peas and beans at these sorting machines of the Northrup-King Seed Company enjoy the 70 foot-candles provided. It relieves the shadows on the feed belt and provides a high intensity for fast, accurate sorting. The management reports the installation is an important factor in attaining a uniform grade of seed. Made at the recommendation of the Idaho Power Company, this installation consists of nine Glassteel diffusers, housing 200-watt clear lamps, mounted 42 in. above the working plane on 49-in. centers. Provision is made for six more stations in this Twin Falls, Idaho, plant

A.I.E.E. Explores Technology and Civic Engineering

Thousand Electricals Convene at Milwaukee to Report Advances in Art and Debate the Duty of Engineers in Public Economic Affairs

DISCUSSION of the participation of the engineer in public affairs reached a new high tide at the recent convention of the American Institute of Electrical Engineers at Milwaukee. Officials of the Institute, of the American Engineering Council and others active in the sections of the society surveyed the status, responsibility and opportunity of the engineer in a world which he, more than any one else, is changing. No conclusions were reached nor action taken, but it is fairly certain that the forum will lead to some form of accelerated civic activity on the part of individual engineers, if not of the whole society.

Meanwhile the technical sessions kept the institute soundly on its high plane of professional prestige. The program was a substantial one for a summer convention; ten technical sessions dealt with as many topics, there were two informal conference sessions and several technical committee meetings to absorb the interest of the 1,040 engineers who attended. Meanwhile, they found opportunity to take advantage of unusually well-organized tours of inspection at the Allis-Chalmers, Cutler-Hammer, Allen-Bradley, Harnischfeger, A. O. Smith, Port Washington, Schlitz Brewing and Globe Union plants. Diversity in processes was matched only by the hospitality and the activity in production at these plants.

Insulation co-ordination steadily being clarified

Not yet transferred fully from the empirical to the arithmetical state, the matter of insulation co-ordination on power systems, however, did take several big strides forward at the session on that subject during the closing day of the A.I.E.E. convention. Its importance and the caliber of the papers attracted the largest of the technical session audiences. The realization of the two main objectives (protection of service and equipment and system economy) are sensibly nearer attainment, at least for lines not embracing too much prior-art equipment.

Two committee reports started the presentation and discussion. G. A. Powel (Westinghouse) first rendered the report of the E.E.I.-N.E.M.A. committee, which sets up basic impulse insulation levels that serve as standardized voltage bench-marks to which the insulation levels of line and station insulators, bushings, transformers, protective devices and other equipment may be referred in the process of selecting a proper or desired level of insulation for co-ordination purposes. In discussion, J. H. Foote (Commonwealth & Southern) called the basic level for the 15-kv. class a bit out of line at 100 kv.; it should be 105 or even 110 kv.

The report on insulation strength of transformers was presented by A. C. Monteith (Westinghouse). V. M. Montsinger (G.E.), another committee member, after tracing the history of co-ordination from the time when it was precipitated by the failure of the 220-kv. Wallenpaupack-Siegfried transformers in 1926, emphasized the factor of minimum time to flashover on a chopped wave. The objective is to insure a sufficiently long wave and surge penetration into the windings; it also prevents in the test the use of short rod gaps and the getting of flashovers that would fall in the rising characteristic of the volt-time curve of the insulation.

J. F. H. Douglass, Marquette University, and A. H. Lovell, University of Michigan

Two schools of protection were represented by the next two papers. J. H. Foote and J. R. North (both Commonwealth & Southern) presented their philosophy in the application of arresters and the selection of insulation levels. It was amplified in the later general discussion by Foote in the following concise terms:

Insulation co-ordination problem

A. DESIGN OF THE INSULATION SYSTEM

1. Determination of the Protected Level—(a) Requires co-ordination of suitable protective device characteristic with the system characteristics existing under surge conditions (voltage between line and ground which may appear across the protective device before or after its operation, expected surge currents, expected power follow currents, etc.); service requirements (continuity, etc.), and economic requirements (revenue, risks which are commercially feasible, etc.). (b) Requires determination of value in crest kv. of Protected Level *under maximum assumed or expected surge* conditions.

2. Determination of the Basic Insulation Level—(a) Requires the determination of a reasonable minimum margin which should exist between the Protected Level and the Basic Insulation Level. This margin again depends on considerations of service and economics. (b) The Basic Insulation Level will ordinarily be that standard level next above the value of crest kv. found by adding the margin to the Protected Level.

3. Selection of apparatus to conform to the Basic Insulation Level—(a) Ordinarily

P. L. Alger, General Electric; Mrs. J. H. Kuhlmann and J. H. Kuhlmann, University of Minnesota

apparatus having insulation strengths equal to or greater than the Basic Insulation Level should be suitable. (b) On occasion certain items or classes of apparatus may be chosen to have characteristics of the next higher insulation level to provide still greater margins of safety, etc.

B. Selection and Location of Protective Devices

1. Selection of devices to prevent imposition of surges on apparatus in so far as possible—(a) Shield wires or nets over station. (b) Ground wires over incoming lines. (c) Special grounds or counterpoises, etc.

2. Selection of devices to protect each incoming avenue—(a) Gaps of various types. (b) Lightning arresters.

These should protect equipment and insulators which will be isolated from major protective equipment by the opening of breakers, etc., and often are adequate if having characteristics similar to a plain gap.

3. Selection of devices to protect solid insulation as found in transformers—(a) Lightning arresters of multi-gap design. (b) Gaps (preferably of special design to give a flat kv. breakdown characteristic with respect to time).

These should be mounted as close to the apparatus to be protected as is possible and the characteristics of these devices will usually be most influential in setting the Protected Level.

Herman Halperin (Chicago) did not consider adequate under severe conditions the Foote-North assumption of 1 kv. per foot for gradient along the line.

A chart that was highly regarded was presented in the paper by Philip Sporn and I. W. Gross (American Gas & Electric). It assembles on the one chart a complete picture of the insulation strength of the major available equipment and protection all the way from 1 kv. to 347 kv.

The second school of practice on protection was presented by H. L. Melvin and R. E. Pierce (Ebasco Services); it dealt with application of spill gaps and their effectiveness in affording protection. In discussion M. A. Lovelady (San Antonio) supplied experience data on 103 repeater-type fused gaps on 12 to 66-kv., all solidly grounded neutrals, with settings in ratios of 2.85 to 1.35 for this spread of voltage. Excessive operation due to switching surges have not been experienced. Out of 341 operations there were 146 one-tube, 49 two-tube, 14 three-tube and 10 four-tube. Sixty of the installations and 182 of the operations were on 66 kv. Practically all are installed on transformers directly at the bushing and in series with the transformer fuse. No tube failures or tube flashovers were reported. Transformer failures have stopped since the installation of fused gaps.

Long time lags are, said H. L. Rorden (Ohio Brass), associated with corona formation and it is improper to show sphere gap flashover curves for slow waves with a long horizontal portion; also, the rod gap will not protect either a sphere gap or the similar solid insulation on the long waves. Gaps are undesirable on bushings because they direct the arc where it is not wanted and they also fail to give the desired protection on overvoltages.

Fear that progress may be stifled if standardization moves too far in stipulating insulation levels of individual component parts was expressed by F. J. Vogel (Westinghouse). The buyer and operator is interested in the overall result of composite equipment.

Internal designs of bushings vary so as greatly to vary the concentration of flux outside at the top, the critical region. Mounting and double stacking of bus insulation introduce variables which warrant ignoring fine margins in selection of insulation levels. These thoughts were advanced by J. T. Lusignan (Ohio Brass). Uncertainties, in the opinion of J. K. Sels (Public Service, N. J.), are still great and maybe many situations are as bad as if un-

D. D. Ewing, Purdue University and Dwight L. Smith, Chicago Rapid Transit

P. M. Lincoln, Cornell University, and R. B. Gear, Commonwealth Edison

co-ordinated. His company is not entirely ready to accept basic insulation levels and protective equipment as affording a degree of protection established beyond peradventure.

Explore recovery voltage

Fault interruption and cable economics engrossed the attention at the Tuesday session on power transmission. Two additional papers in the series by the joint E.E.I.-A.T.&T. committee on inductive co-ordination were presented for the record, but no discussion ensued. Discussion was, however, active on the proposal (in the Evans-Monteith paper) to use the a.c. calculating board in conjunction with determinations of system recovery voltage. No claim was made that the technique was broadly applicable for all types of system analyses, but it was asserted that it was easy to get the recovery characteristics after a two-line-to-fault ground, whereas derivation by computation was tedious.

Several General Electric engineers pointed to the acknowledged limitations of the board method, among them S. P. Crary, R. G. Lorraine, W. F. Skeats. Thus, the static set-up is not amenable to the saliency aspects of rotating machines; more applicable to behavior of line protective gaps than to breaker speeds; more must be known about system constants if the a.c. board is to be increasingly useful in getting at recovery voltage.

That the need for more knowledge on recovery voltage is not confined to breakers, tubes and arresters was pointed out by J. R. North of Commonwealth & Southern. Synchronizing and fuse operation are further instances. He joined H. M. Trueblood of the Bell system in urging the acquisition of more data. H. P. St. Clair (American Gas & Electric) said the method was

useful in making decisions on installation of protective tubes, but, after the constants are once ascertained, the approach by computation is not difficult. He also suggested that high frequency might disclose the capacitances which are the principal uncertainties in simulating the system ramifications on the a.c. calculating board.

Chicago adds cable

Four new 66-kv. oil-filled cables of as many makes and totaling about 100 miles are being installed in Chicago and many advances in technique were reported by Herman Halperin and G. B. Shanklin. Capacity, comparative to the previous installations, has been doubled with no change in outside diameter. A 75 per cent reduction in volume of stop joints was effected. Reservoirs are smaller and conform to standard size manholes. Copper-bearing lead was used in the sheaths at a 5 per cent saving. Installation was continuous over the 168 hours of the week, a trailer being placed over the manhole to facilitate the work and safeguard operations. On the whole, the progress in the cable art since 1926 has nearly halved the cost per kv. of cable capacity if expressed in terms of the present estimated and 1926-27 actual costs of the 132-kv. oil-filled cable.

The authors had said that there was nothing mysterious now about oil-filled cable installation and operation. Nor was there any mystery about its manufacture, added W. A. DelMar of Habirshaw. No test assures absolute perfection of solid cables, but mobility of the oil in the oil-filled cable affords access to every cranny of the cable. Perfect operating records of oil-filled cables enable producers to focus wholly on cost reduction, whereas with solid cable much energy has to be devoted to improvement in performance. "Solid cables can only be made better and better, but oil-filled cables can be made cheaper and cheaper." The oil-filled practice is thus destined to be the increasing choice, in his opinion.

Extension of production technique

After several years' work among manufacturers' laboratories, a joint E.E.I.-N.E.M.A. committee was enabled to have its chairman, C. A. Powel, report that values had been agreed upon for impulse and 60-cycle flashover values for rod gaps and suspension line insulators. The unpretentiousness of the paper fails to indicate its significance to the extension of the

C. D. Brown, Milwaukee Electric Railway & Light; R. T. Henry, Buffalo, Niagara & Eastern

art of protection against outages from impulses. Actually it represents a reduction from 30 per cent (1930) to a present 2 per cent discrepancy between laboratories.

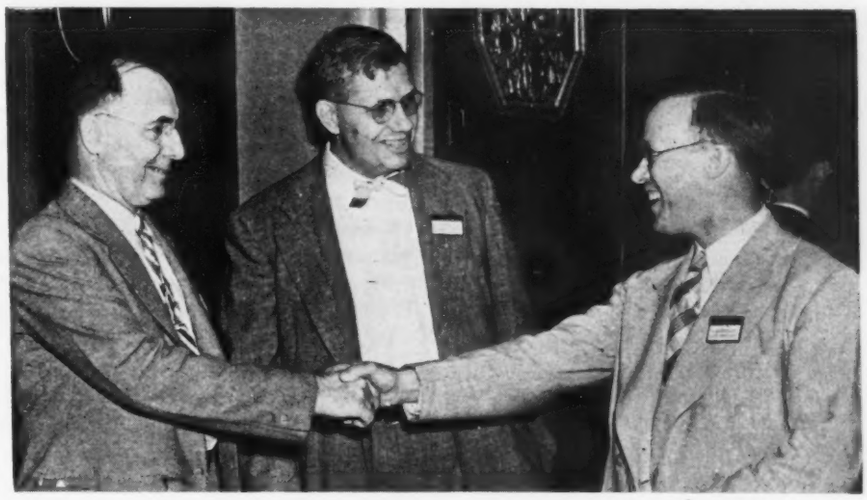
Survey of the performances of more than 14,000 expulsion protective gaps on lines of from 13 to 132 kw. was reported by W. J. Rudge and E. J. Wade of G. E. Only 1/40 of 1 per cent were found to present evidence of bursting due to lightning discharge.

Careless application can, according to a communication from L. G. Smith (Baltimore) distort the dielectric field so as to destroy the co-ordination between gap and line insulation or between internal and external flashover. Also successful application to systems with ungrounded neutral is doubted. Further, mountings have loosened and external gaps shifted under the influence of swelling of crossarms or shift in guys or hardware under storm strains. No tripouts at Baltimore have been experienced even on lines where gaps were installed on every fourth pole. Prior to gap installations in 1935 each of two feeders tripped out five times with conductor burndowns. Tubes will be placed on every sixth pole of a double-circuit line and impulse level of unguyed poles raised to 700 kv. Smith believes that the expulsion protective gap has a real future if satisfactory weathering can be assured. R. L. Thomas of the same city likewise emphasized the mounting. To avert troubles from this source horns were shortened to increase the external gap. Otherwise a device intended to minimize short interruptions might be guilty of causing prolonged ones.

Surge protection of distribution

Surge current discharge capacity of protectors should, according to the Hodnette-Ludwig (Westinghouse) paper be 100,000 amp. to prevent all lightning damage, but half that value will give satisfactory results.

From W. H. Cooney (Pittsfield) came the suggestion that it is not generally considered economically feasible to give distribution transformers the degree of maintenance and inspection given to substation and power transformers. Some may thus have low oil levels or a degree of water infusion; others may have been carbonized from excessive overload; any of these deteriorations tend to lower the impulse strength. In order to avoid trading on the margin of strength above the demonstrated value, it would seem to Cooney essential to provide a wide margin between the demonstrated impulse strength of the transformer and the voltage levels permitted by the protective device, in view of the effect of



W. T. Ryan, University of Minnesota; M. C. Hughes, Texas A. & M. College; P. S. Biegler, University of Southern California

J. H. Foote and J. R. North, Commonwealth & Southern, and Frank F. Fowle, Frank F. Fowle Company

repeated impulse voltage and the possibility of deterioration of impulse strength in service.

Rare instances of more than a few hundred impulse amperes were found through the medium of 300 surge crest amperes observed by Herman Halperin of Chicago. F. E. Andrews (Public Service of Northern Illinois), however, said the rural values would likely exceed the city values of Halperin; he experienced failure of arresters from discharge current causes. Higher value of rate of rise for testing distribution transformers and protection was urged by I. W. Gross (American Gas & Electric). He further said that there was much confusion about the catalogue listing of arresters on a line voltage basis.

In closure, J. K. Hodnette indicated the belief that insulation deterioration with time is largely a matter of the unfavorable experience with the scant bushings built into transformers of a decade back.

Electric furnace ratings

Ratio of surface to mass of the melt is a large factor in determining the rate of heat and kilowatt input, said Frank Brooke of Swindell-Dressler Corporation to the conference on electrical apparatus for three-phase arc furnace ratings conducted by N. R. Stansel. No one abuses electrical equipment more than the electric melter, because his incentive is to turn out steel or alloy. Ratings have to have a wide margin to provide for forced output. Approximate relationship of furnace sizes, charge and electrical ratings were given thus

Inside Diameter (Ft.)	Tons per Charge	Kva. Input
5	1	500
6	2	1,000
7½	4	2,500
11½	10	4,000
13½	25	5,000
15	35	7,500

One installation recently surveyed showed 5,500,000 kw.-hr. per month consumption at 82.1 per cent power factor. F. V. Andreae of Ohio Ferro-Alloys mentioned a recent European furnace of 10,000 kw. operating at 50 volts and 92 per cent power factor. But too high a power factor tends to erratic and unstable arc operation. F. E. Ackley (General Electric) cited an instance where input of 900 kw.-hr. per ton at 3,000 amp. was brought down to 600 kw.-hr. per ton and 1,500 amp. merely by regulating for optimum power factor at the arc through watching the energy meters. Further, it is more important in regulation to shorten the time in getting the electrode moving to a new position than to have high speed afterward. Electronic control, said Ackley, has a good future because tube characteristics readily meet anti-hunting requirements of electrode regulation.

Short-circuit kva. of the system is a good index of the point from which to serve a furnace load if flicker is not to exceed the 2-volt secondary limit. Thus a 1,000-kva. furnace load is about the limit on an ordinary 4.8-kv. substation, said L. W. Clark of Detroit Edison. It might be 10,000 kva. at a point on the 22-kva. system where short-circuit kva. is 800,000.

Motor overloads and contactors

Starting off the session on general power applications came the paper on a.c. motor protection by G. W. Kuhn. Convenient data for investigation of motor protection are "protection" curves compared with "tripping time" curves of thermal overload relays. Thus the capacity of the motor at different expected ambient temperatures may be compared with the capacity of the overload relay at its corresponding ambient temperatures. "Protection" curves show the time required for the motor windings to reach a certain maximum safe temperature. Obviously the temperature conditions surrounding the motor will determine its safe load operation and those surrounding the thermal overload device will have their effect on its functioning. Therefore, operation of overload protection with devices built into the motor will be different from operation with the device apart from the motor. The comparison of "protection" and "tripping time" curves takes such differences into account and can be very useful in thermal overload equipment design.

In the following discussion C. G. Veinott explained the functioning of built-in overload devices which are actuated by motor temperature alone and indicated a considerable faith in their effectiveness. F. E. Harrell stated the opinion that for large motors the external device reflecting current conditions was quite acceptable.

Magnetic contactors as commutating devices for the application of power for very brief periods, as in resistance welding practice, have encountered limitations that have been considered inherent in their nature. But in his paper on impulse operation of magnetic contactors Carroll Stansbury disclosed that this is not necessarily the case and described a method of operating such devices which quite successfully avoids the usual limitations and allows energy application for very accurately determined short periods of time. This has been accomplished by energizing the contactor coil by a single unidirectional pulse of current such as may be obtained by discharge of a condenser in a properly designed electron tube control circuit, synchronously associated with the main energy supply.

Saves Money With All-Electric Service

Present Cost Less Than Was Spent for Electricity, Gas, Ice and Coal for Kitchen Range

By H. N. WELLS
County Agricultural Agent, Claremont, N. H.

Seldom does ELECTRICAL WORLD *have an opportunity to give the industry as complete a cost analysis of home service as Mr. Wells has prepared on the basis of subdivided metering in his own residence in Claremont, comparing expenses before and after complete electrification. For several years he has been co-operating in securing rural line extensions for farmers in Sullivan County, and he undertook this cost study to secure first-hand data on what complete electric service really means. In a year's run electric costs were lower than by the previous methods by 25 cents per month, allowing nothing for the many advantages of electrical operation over the older practices.*

IS ELECTRICITY too expensive for greater domestic use? This question, in relation to our home, had troubled us for some time. For several years we had dreamed about a more extensive use of electrical equipment. We already had lighting service, a toaster, vacuum cleaner, washer and other small appliances, but we wanted an electric range, refrigerator and water heater to complete our home equipment. Discussions with our friends led us to believe that the cost of operation would be too high for ordinary folks with average incomes, and so we had "stuck to" coal and gas.

H. N. Wells and fully electrified home of Mr. and Mrs. Wells

Hour of decision strikes

Finally, "there came a time" to make a decision. Our copper range boiler (which had been in use about 40 years) sprung a-leak, and although we had it patched up, we were always fearful that it would give out when we were away from home. Then, too, the gas range was old and Mrs. Wells complained that it did not bake well, while the coal and ashes made an awful lot of dirt and dust around the kitchen. So we decided that if we were ever going to change to electric cooking, refrigeration and water heating, now was the appointed time. There were four in the family to provide for. In addition to the coal range and hot water tank we had a gas range in the kitchen. There was also a side-arm gas heater on the tank for summer use. We used the gas range for getting breakfast and some emergency baking when the coal fire was low. It was also used in summer. On the porch we had an ice refrigerator used from May to September.

Our local electric rates (Central Vermont Public Service Corporation) are on a sliding scale: 8 cents per kw.-hr. for the first 30, 5 cents each for the next 60 and 2 cents each above 90 for all purposes except water heating. A special rate of 1.5 cents per kw.-hr. is offered for off-peak usage. This off-peak period is any time except between 7 a.m. to noon and from 1 to 5 p.m., local industries creating a peak between the above hours. With this ar-

Electric range in author's kitchen

rangement a 52-gal. insulated hot water tank stores enough to tide over an ordinary-sized family during the forenoon and afternoon periods when the water heating current is off.

The gas rates are also on a sliding scale, the first 500 cu.ft. costing $1.15; the next 500, 18 cents per 100 cu.ft.; the next 1,000, 17 cents, and so on until over 5,000 costs 15 cents per 100 cu.ft.

A little study showed us that our consumption of either electricity or gas was only enough to keep us in the top rate brackets. Moreover, 2 tons of range coal cost us $30 per year, and the ice bill for five months was $15 or more. We reasoned that if we changed over to full electric service the added consumption would be paid for under the 2-cent and 1.5-cent rates. So we decided to "take the plunge" and out went the old stoves and hot water tank and in came a new Hotpoint range (8,060 watts connected load) with four units and an oven, a 5.2-cu. ft. refrigerator (G.E.K-5) with a 0.25-hp. motor, and a Hotpoint water heater rated at 2,500 watts, along with a 52-gal. tank being placed in the cellar.

We naturally were deeply interested to know what the operating costs would be and whether more or less than with our old set-up. Also, since I have been working for several years on rural extensions so that farmers could have the benefit of modern conveniences, I wanted to be able to supply them with definite information. So I requested the loan of several meters, and when the new heavier duty equipment was installed I had one placed in circuit with each appliance.

It has been gratifying to learn from our carefully kept records that first of all our total operating bill with electricity has been less than with the old set-up with gas, coal, ice and electricity. It cost us $127.38 per year for electricity against $130.49 with the old equipment. Besides the lower cost, electrical service has been much more convenient and far cleaner.

Electric refrigerator is located in kitchen

The low cost of operating the electric range and refrigerator was particularly gratifying.

Our monthly cost averaged $3.45 for lighting and small accessory service, $1.04 for the refrigerator, $2.07 for the range and $4 for the water heater.

Looking at the over-all bill, it would seem that a trifle over 26 cents per week for electric refrigeration right in the kitchen (no mean point of convenience in itself!) and a little over 50 cents per week for electric cooking cannot be considered exorbitant.

Table III—Comparative Costs of Service in Author's Home

1935	All Electric Equipment Including Water Heater	Total Cost Previous Year for Gas, Electricity, Range, Coal and Ice
August	$7.60	$7.60
September	10.51	12.37
October	10.75	10.83
November	11.70	15.45
December	11.60	12.49
1936		
January	12.11	10.53
February	11.77	10.14
March	11.57	9.63
April	10.87	9.16
May	10.77	11.80
June	9.53	11.33
July	8.60	9.16
Total	$127.38	$130.49
Average per month	$10.62	$10.87

Table I—Kilowatt-Hours Used Each Month in Author's Home

Month 1935	Lights and Miscellaneous	Refrigerator	Range	Total	Water Heater	Grand Total
August	26	21	31	78	193	271
September	58	20	69	147	258	405
October	62	19	80	161	262	423
November	78	19	91	188	289	477
December	74	19	97	190	280	470
1936						
January	72	19	99	190	314	504
February	66	17	94	177	309	486
March	60	20	95	175	298	473
April	48	19	85	152	282	434
May	45	23	83	151	277	428
June	28	22	70	120	235	355
July	19	23	49	91	203	294
Total	636	241	943	1,820	3,200	5,020
Average	53	20.1	78.6	152	267	419

Table II—Cost of Electricity in Author's Home

Month 1935	Lights and Miscellaneous	Refrigerator	Range	Total	Water Heater	Grand Total
August	$2.08	$1.07	$1.55	$4.70	$2.90	$7.60
September	3.80	1.00	1.84	6.64	3.87	10.51
October	4.00	0.95	1.87	6.82	3.93	10.75
November	4.80	0.74	1.82	7.36	4.34	11.70
December	4.60	0.86	1.94	7.40	4.20	11.60
1936						
January	4.50	0.92	1.98	7.40	4.71	12.11
February	4.20	0.85	2.09	7.14	4.63	11.77
March	3.90	1.00	2.20	7.10	4.47	11.57
April	3.30	0.95	2.39	6.64	4.23	10.87
May	3.15	1.15	2.32	6.62	4.15	10.77
June	2.24	1.16	2.60	6.00	3.53	9.53
July	1.52	1.78	2.25	5.55	3.05	8.60
Total	$41.37	$12.43	$24.85	$79.37	$48.01	$127.38
Average	$3.45	$1.04	$2.07	$6.61	$4.00	$10.61

Vienna Stores Steam for Momentary Peaks

Eight Accumulators at 1,700 Lb. Serve 20,000-Kw. Turbines While Boilers Pick Up Sudden Demand

By FRANS STIPERNITZ *
Vienna Municipal Electric Plant

MODERN water tube boilers, particularly those of the forced circulation type, contain very small volumes of water per pound of steam produced per hour. Consequently, such boilers have small heat storage and, if called upon for sudden additional steam requirements, cannot meet this quick demand from the accumulator effect of the water in the boiler without a large decrease in pressure. In general, this would lead to a decrease in the available power from the connected turbines.

A momentary reserve is desirable during the time the fires are brought up to operating conditions. This is particularly desirable where a city is supplied by hydro-electric power from distant plants by transmission lines subject to outage from lightning and other causes. The steam power plant should possess that momentary steam reserve necessary to enable the load to be carried until the boiler furnaces are in full operation. The Ruths and Kiesselback accumulators are not favored as they require a special low-pressure turbine to utilize the steam evolved on discharge and use much steam. These systems are expensive to install (costing in Europe 150 to 200 reichsmarks per kilowatt of installed capacity).

At Simmering station a lapse of two minutes was found necessary from the lighting of the oil-fired burners under the stand-by boilers until full steam output was available. Some form of accumulator was believed necessary to bridge this interval. Such an accumulator for high pressures has been built at a cost of 30 Austrian shillings per kilowatt of connected capacity for a maximum of a four-minute interval.

*Abstract of paper at Vienna Congress of the Union Internationale de Tramways, de Chemins de Fer d'Intérêt Local et de Transports Publics Automobiles.

Accumulated steam superheated

The accumulator installation consists of eight horizontal cylinders of heavy forged steel placed in the boiler room of the plant. They are about 29 ft. long and 4 ft. in diameter. These cylinders are filled with hot water and charged with steam from a small oil-fired forced circulation boiler capable of raising the pressure in the accumulator to 1,700 lb. per square inch. The regular operating pressure of Simmering station is 500 lb. per square inch.

Six of these cylinders act as steam accumulators. These discharge through a pressure control valve which maintains the steam supply to the station's steam main at 500 lb. per square inch. Reference to a Mollier diagram will indicate that saturated steam at 1,700 lb. per square inch becomes quite wet when throttled to 500 lb. per square inch. Hence, some drying and superheating of this steam must be provided. This is accomplished in the two upper cylinders of the accumulator, where the vapor from the water in these two drums at 1,700 lb. per square inch is sufficient for this purpose. No difficulty is expected from the use of saturated or slightly superheated steam at 500 lb. per square inch in the stand-by turbines, although the normal operating temperature is 750 deg. F. Simmering station normally has turbines totaling 20,000 kw. operated by steam at speed, but carrying only wattless current for power-factor correction, with the long transmission lines furnishing energy from hydro-electric plants. These turbines serve as a spinning reserve with oil-fired boilers under pressure. The accumulator installation serves as a momentary reserve to these boilers in case of sudden stop.

Comments on the Vienna System

By A. G. CHRISTIE
Professor of Mechanical Engineering, Johns Hopkins University

An instantaneous steam stand-by at the load center is a valuable and desirable adjunct to any hydro-electric system with long transmission lines. In American practice steam plants are generally maintained for this service with reserve units of sufficient capacity operating at speed for instant use should an outage occur on the hydro supply. These turbines are such that they can carry capacity at falling steam pressure during the interval necessary to get the furnace fires in operating condition. With underfeed stokers, powdered coal, oil or gas firing the time taken in this country to get up to furnace temperature is quite small. It is generally possible to pick up the dropped load with steam without any noticeable outage of service to the customers.

American engineers have not used accumulators in central stations, although such apparatus appears to have certain advantages in costs and reserve capacity. Preference has been given to more liberal furnace capacities, to devices to assure rapid build-up of furnace temperatures and to auxiliary equipment, such as forced and induced draft fans capable of rapid acceleration in case of need.

In certain cases, as in one of the

[*Continued on page 101*]

Insulator Dynamics Benefit by

Precision Measurements Perfected to Determine Dynamic Characteristics of Suspension Insulators Under Service Stresses

By LOUIS A. MEISSE and JOHN J. TAYLOR *
Research Engineers, Ohio Brass Company, Mansfield, Ohio

COMPONENT parts of an insulator assembly are subject, in service, to continual adjustments caused by load and temperature change. When insulators leave the factory they are, presumably, in the best possible condition for the duty demanded of them; any subsequent progressive change that takes place makes the insulator less fit for service than it was originally.

To assure ourselves that insulators being sold today promise adequate service life we may either (1) supply unchanged designs on which service records have been established or (2) compare the characteristics of proposed new designs with those of older designs that have been proved satisfactory. In such a comparison due weight should be given to both static and dynamic characteristics. One method of investigating the latter, by the use of precise measurements, will be described. It affords valuable information about new designs and for checking the adequacy of those already developed.

In service a suspension insulator, subject to constantly changing loads and temperatures, is a dynamic device rather than a static one. A study of dynamic performance in the working load range is made most readily by actual measurement of the distortion that occurs in vital sections and of the movements that take place between different parts of the assembly when there is a change of load or temperature. Having a measure of both static and dynamic properties, and being supplied with service records of designs so measured, there has been established a reasonable basis for estimates of service life of existing designs and those that are in process of development.

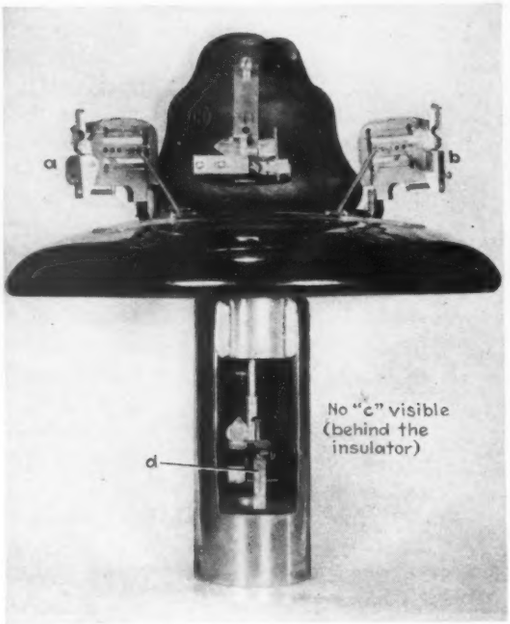


Fig. 1—Distortion gages attached to insulator

Three gages, *a*, *b* and *c* (*c* not visible), were attached to measure the movement between the metal cap and the dielectric body in a direction parallel to the insulator axis. Gage *d* recorded movement between the embedded end of the suspension pin and an adjacent surface of the dielectric. Tangential stresses in the cap wall at different levels were measured by strain gages *e* and *f*. Gage *f*, which measured the stresses at the extreme lower edge of the cap, is not visible in the picture.

Distortions are in mils

Distortions and movements to be measured in an insulator are generally in the order of 0.001 in. A method of measurement originated by Dr. L. B. Tuckerman of the U. S. National Bureau of Standards and expanded in applicability by one of the authors was used to obtain readings with an accuracy of 0.00001 in. The apparatus is shown on the next page.

Attachment of the gage bodies to an insulator is shown in Fig. 1, which also shows the functions performed by the respective gages. To obtain specimen temperatures above or below room temperature a heat-insulating cell fitted with electrical heating and refrigeration was used. Double windows in the walls of the cell permitted readings of the several strain gages.

Mechanical load in increments of 1,000 lb. was applied to the insulators by a standard tensile machine rebuilt to provide automatic poise advance and load balancing. Insulators were preloaded to eliminate misleading initial adjustments. Test loads were applied in increments of 1,000 lb. up to 40 per cent of the ultimate tensile strength of the specimen, then decreased in the same manner to the initial value of 1,000 lb. Initial readings of the six gages were made simultaneously at each change of load and a second reading, without change of load, was made after intervals varying from fifteen seconds to several hours. The "delayed" readings permitted a distinction between movements resulting from elastic deformation and those caused by slip at lubricated wedge surfaces.

Complete cycles of loading were repeated until a stable condition was shown by the specimen.

Measurements of cap movement

Typical load-deflection curves for caps having wedge angles of 30 deg. and 20 deg. are shown in Fig. 2. The horizontal width of the closed loops is a measure of the axial component of load necessary to overcome appar-

* Abstract of paper presented at International Conference on Large Electric High Tension Systems, Paris, June 24 to July 2, 1937.

Precision Tests

ent friction at the sliding surfaces. What appears to be friction is, actually, a joint result of friction and viscous flow of the lubricant used.

The 16 deg. F. cycle in Fig. 2a shows definite cap movements during each fifteen-second interval of constant load. Similarly examined, the 16 deg. cycle in Fig. 2b shows only two cap movements. With small angles of cap wedge and in the lower brackets of service temperature slip surfaces may not operate as such and the stresses set up are limited only by the contracting effort of the cap wall. The severity of these stresses is determined by the weight of the cap section; by the temperature at which, for an expected rate of thermal change, the slip surfaces become practically inoperative, and by the amount of radial relief provided in the form of sanded and treated grip surfaces on the dielectric.

Measurement of pin movement

Examination of deflection curves for different pin constructions (Fig. 3) shows (1) large total movements and narrow (hysteresis) loops for *a* and *b*, both of which were obtained on pins of resilient construction; (2) a characteristically shorter movement and broader loop for *c*, which has lubricated wedge surfaces. Load-deflection characteristics for the wedge surfaces and the fin member of the step-fin pin are additive, their joint result being shown in curve *e*.

Because of its smaller load-bearing areas, pin design is of primary importance with regard to axial load on the insulator; conversely, cap design is of primary importance with regard to thermal stresses because of the increased differential expansion and contraction of large diameter parts. It should be clearly understood, however, that under any condition of loading, stresses in the dielectric are a joint result of both hardware parts. Having chosen one part of an assembly we immediately impose new limits on the remainder of the design.

Having chosen a pin design that, in combination with a thermally safe cap, affords satisfactory stress distribution throughout the dielectric, precautions must be taken to guard against change in this initial distribution as a result of the countless cycles of pin movements that occur in service. Measurements of pin movements during repetitive cycles of load and temperature change permit this type of stability to be checked.

Measurement of tangential stresses in the cap wall

Different designs may be expected to show, for a given axial load, widely varying amounts of cap stress. This is illustrated in Fig. 4. Measurements of tangential cap stresses as distinct

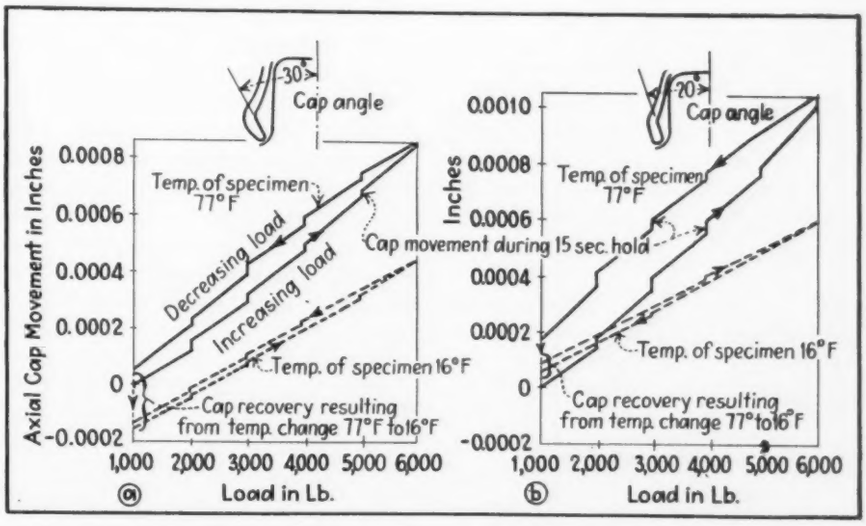


Fig. 2—Cap angle and specimen temperature influence cap movement cycle

(a) Cap angle 30 deg. (b) Cap angle 20 deg. Loop widths (at 77 deg. F.) are in the ratio 1 :1.7. Since similar axial loads on 30 deg. and 20 deg. caps have, coincidentally, radial loads in the proportion 1 :1.6, it follows that the 20 deg. cap requires, for a recovery movement, compressive loads on the dielectric approximately 1.7 × 1.6 or 2.5 times those required for the 30 deg. cap. For cap angles less than 20 deg. the comparison is increasingly favorable.

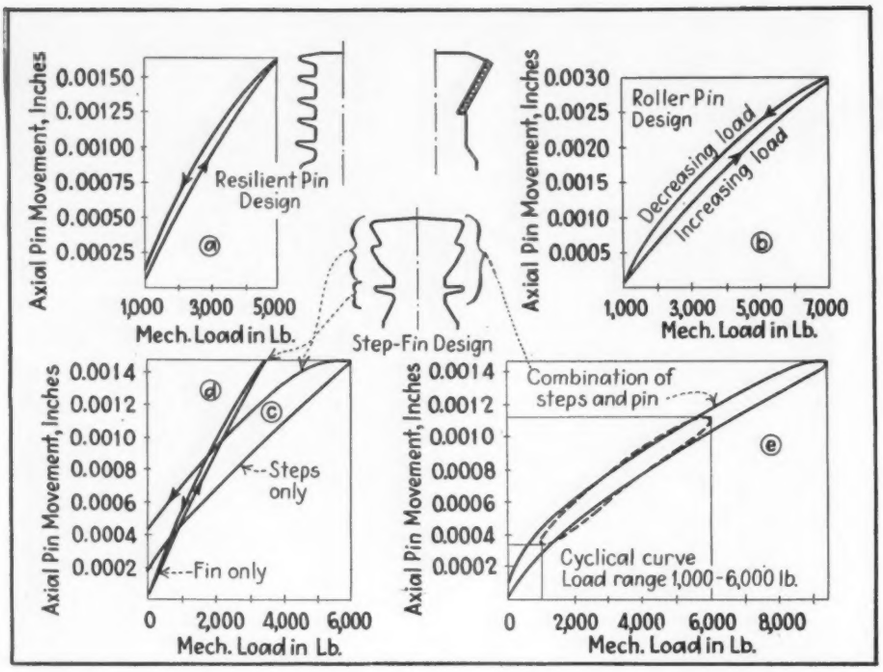


Fig. 3—Typical pin movement curves show comparative hysteresis

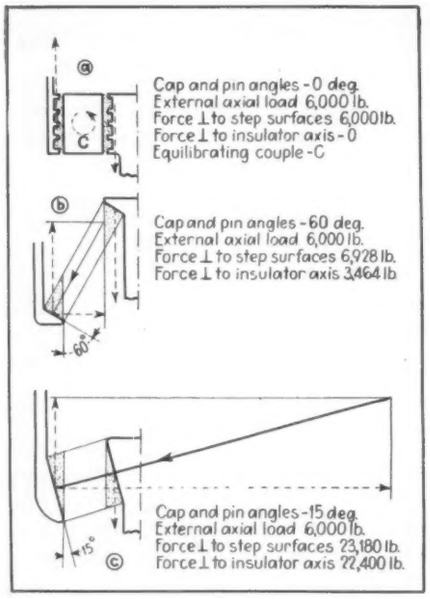

a
Cap and pin angles - 0 deg.
External axial load 6,000 lb.
Force ⊥ to step surfaces 6,000 lb.
Force ⊥ to insulator axis - 0
Equilibrating couple - C
b
Cap and pin angles - 60 deg.
External axial load 6,000 lb.
Force ⊥ to step surfaces 6,928 lb.
Force ⊥ to insulator axis 3,464 lb.
60°
Cap and pin angles - 15 deg.
External axial load 6,000 lb.
Force ⊥ to step surfaces 23,180 lb.
Force ⊥ to insulator axis 22,400 lb.
15°
c

Fig. 4—Cap wall stresses give index of design

Sketches show axial load and equilibrating forces, neglecting friction.

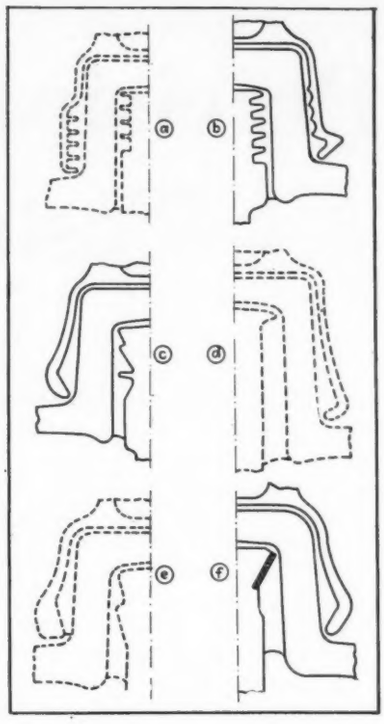


Fig. 5—Assembly harmonizes performance requirements with requirements of fabrication

(a) A theoretical design having multiple load bearing surfaces perpendicular to the axis symmetry.

(b) Commercial product approximating the (a) type of construction.

(d) Wedge construction with load bearing areas at an angle of 60 deg. to the axis. Note the additional length of head and the small load bearing areas.

(e) Wedge construction with 15 deg. angles. A heavy bead on the insulator cap is required because of the radial component of load.

(c) Wedge angles approximately 30 deg. and with special pin construction which contributes an axial recovery force.

(f) Moderate wedge insulator with special pin construction. The spring roller surface produces a uniform distribution of stress on the pinhole wall. Adjustments of pin location do not introduce the friction and viscosity characteristics of a lubricated wedge.

from measurements of axial cap movement supply important design information: (1) The actual amount of radial compressive stress brought to bear on the dielectric when the insulator is subjected to a predetermined mechanical tension. (2) The necessary section of metal and its optimum shape. (3) By comparing theoretical with observed stresses, the friction at the wedge surface may be calculated.

It is apparent from Fig. 4c that the measurable external load, 6,000 lb. in the diagram mentioned, may be insignificant compared to the hidden loads built up within the insulator head and determined by a choice of design. With decreasing cap angle we have (1) more necessity for relief by cap movement and (2) less chance of obtaining this movement.

Design for dynamic stability

Although we have for convenience discussed cap-and-pin movement and tangential cap stresses under separate headings, it will be understood that the component parts of a design must work together harmoniously to satisfy definite service requirements and to permit manufacture of the final product at a reasonable cost.

For mechanical strengths that do not make the resultant "couple" (see Fig. 4a) a limiting factor, load-carrying surfaces perpendicular to the insulator axis have important advantages. With this arrangement the sections of hardware parts can be kept to a minimum, slip surfaces are not a vital part of the design and axial movements of the hardware parts are wholly elastic. Fig. 5b is of this type and has proved itself remarkably free from alterations, in service, of the characteristics originally supplied.

With wedge constructions a couple does not necessarily obtain in the side walls of the insulator head, but other limitations must be considered. Large angles of wedge require additional length in the insulator head, and this prevents close spacing of the several units in a string. The additional length of insulator head is not used effectively, since only a small part of the dielectric surface carries load.

With small angles of wedge the internal stresses that result from a given external load are disproportionally large. Moreover, the movements at slip surfaces assume an undesirable importance.

To avoid these disadvantages the intermediate constructions shown in Figs. 5c and 5f may be used, these having refinements to facilitate pin recovery and to assure stability of performance during the expected service life.

Many Control Steps With Few Contactors

Vernier Speed Control and Smooth Acceleration by Adaptation of Traction Motor Control to Industrial Motors

By G. L. MOSES
Railway Engineer Westinghouse Electric & Mfg. Co.

WHERE a large number of steps are required for fine speed control or smooth acceleration a new control circuit originally developed for traction motors probably offers the most efficient use of contactors and resistors yet devised. This is a "Vernier" scheme producing relatively small increments of speed and torque with the least apparatus by repeatedly using a common tapped section of resistance in progressive combinations with relatively large sections of fixed resistance.

The operation of this system is as follows:

1. All the sections are first connected in series.

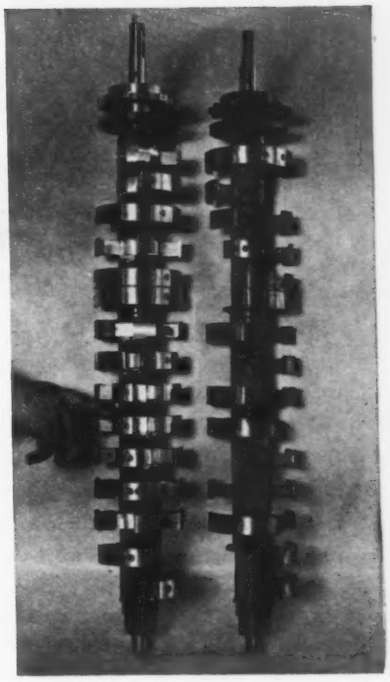
2. Steps of the "Vernier" section of the resistor are notched out by progression of the control until all of the "Vernier" resistor section is cut out, leaving only the fixed section (or sections) of resistor.

3. Next the "Vernier" section of the resistor is paralleled with one of the fixed sections of the resistor and the effective resistance is varied by notching out the "Vernier" section of resistor while it is connected in parallel with the fixed resistor section.

4. Where more than one section of fixed resistor is used the "Vernier" section is repeatedly paralleled with each successive section and the "Vernier" contracts notched through their sequence.

Scheme utilizes gradation

The schematic circuits and contactor sequence are shown in the accompanying illustration, which follows the preceding description of the operating sequence.



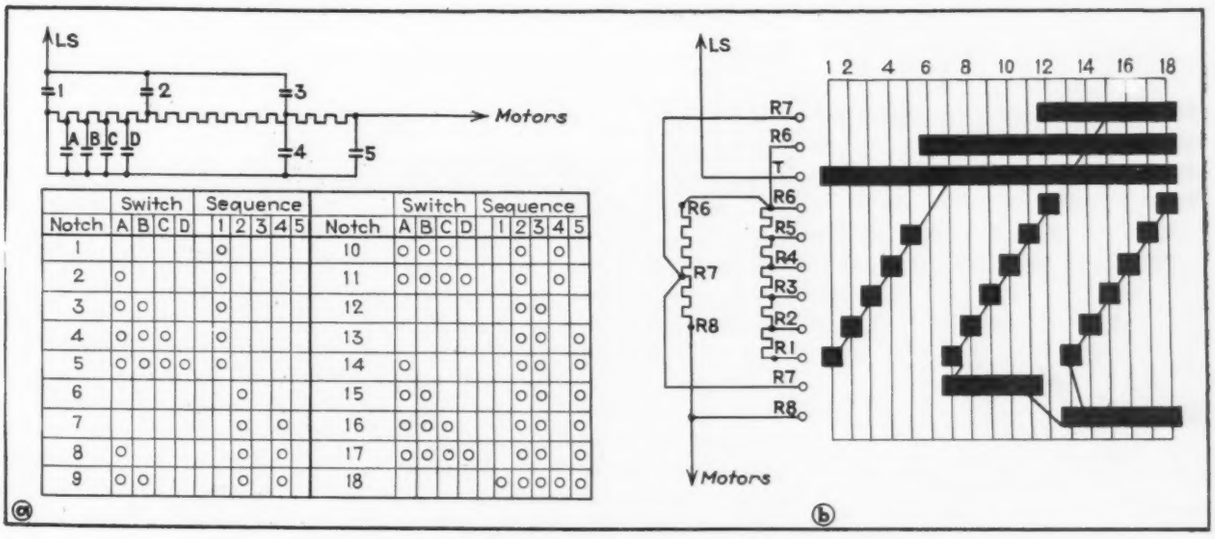
Drums for eight-notch and 22-notch controllers

Hand indicates 22-notch drum. The gain is pronounced.

The result of this method of utilizing the resistor notching contactors is that each "Vernier" contactor produces as many notches as there are sections of the resistor (counting the "Vernier" as a single section.) This results in very efficient utilization of the contact devices and resistor, thereby producing a maximum number of satisfactory notches with a minimum of apparatus.

This system utilizes the fact that the early notches require relatively

[*Continued on page* 102]



"Vernier" control contactor scheme

(a) Gives eighteen notches with nine contactors. (b) Vernier control drum scheme.

A Meterman Treats Instrument Transformers

Notes on Practicability, Accuracy and Convenience in Calibrating and Testing

Most metermen know the reliable methods of testing instrument transformers. It would be fine if the job and the requisite facilities were as simple as in testing watt-hour meters. Since they are not, it is easy to overlook the limitations of some of these procedures and here are some words of reminder.

IN RECENT years the growth in magnitude and importance of power loads and the increase in the standard accuracy required in electrical measurements have stressed the importance of calibration methods and apparatus for checking the accuracy of instrument transformers. In a paper before the New England meter committee H. J. Murphy of the New England Power Company, Worcester, reviewed several of these methods and commented upon present-day needs in this field. The author held that the deflection method of calibrating instrument transformers is greatly impaired as to practical value since the accuracy is seriously limited by the accuracy and available ranges of instruments. This method also gives no indication of polarity or phase angle. Use of wattmeters improves the accuracy of the method and permits determining polarity and phase angle, but available wattmeters limit the range of application considerably. Null methods were declared to be inherently highly accurate and are therefore generally used.

Potential transformer test by the primary null method is capable of very high precision, but several precautions must be taken: (1) Contact resistance must be practically eliminated; (2) the resistors must have negligible inductance and distributed capacitance, and (3) the resistance and inductance values must be unaffected by changes in temperature or stray fields. Complete insurance against errors is somewhat costly. The equipment should be made nonportable and auxiliary apparatus carefully selected; also, its use should be restricted to standardization laboratories for certification purposes.

Also described by Mr. Murphy, the primary null method of current transformer testing has all the limitations of the potential transformer test. Unless special adjustments are made it is difficult to test current transformers with low burden, as the secondary shunt is really added to the secondary burden.

The wattmeter method used in the potential transformer test may be adapted to testing current transformers. Its accuracy depends upon the calibration of the wattmeter and ability to read between divisions. Another limitation is the difficulty in determining which transformer has the larger ratio and phase angle. This method, however, is very suitable to ascertain that the test transformer is within certain accuracy limits.

Interchanged wattmeters

The interchanged wattmeter method, which is sometimes modified by substituting watt-hour meters, in current transformer testing, may be adapted to testing potential transformers. Higher accuracy results are possible from watt-hour readings than can be had from instantaneous readings. Limitations are: (1) The accuracy depends on the ability to read instruments closely; (2) the wattmeters are added to the transformer burden.

After describing the Silsbee method of current and potential transformer testing the author made the following general comments on testing:

(a) Some of the methods are capable of high precision, but are expensive and difficult to maintain and operate; (b) some require detectors or calibrated parts that need frequent adjustments; (c) the null methods are in general capable of greater accuracy, as differences can be measured closer than absolute values. The null method also has the advantage that since no current flows through the detector when a balance is obtained, contact resistance can be practically eliminated by placing contacts in the detector circuit.

(a) Testing method should be adequately accurate; (b) give a direct check on polarity; (c) be simple and reasonably quick in manipulation; (d) be direct reading, or at least should not involve long computations; (e) be rugged; (f) be insensitive to stray fields or varying supply voltage; (g) not require a polyphase source of supply.

Insulation tests

A tendency exists to regard insulation as something more important to the line than to the meter. However, a meterman is interested in insulation from a safety standpoint. Although insulation failures in the primaries of instrument transformers react principally upon the line and are promptly detected, insulation failure in the secondary at any point except that which is grounded introduces errors not easily detected and which may continue to exist over long periods.

Recent developments of testing apparatus have given manufacturers of instrument transformers the necessary information to design transformers to withstand definite impulse voltages. They worry very little about the ability of recently designed equipment to withstand the old high-potential test of 2 1/4 times normal voltage plus 2,000 volts between primary and secondary or ground, 10 kv. minimum and 2,500 volts between secondary and ground. However, many transformers now in meter stores or service will not meet the new A.S.A. requirements for insulation, and probably many are in use which cannot pass the old tests. New England Power applies the high-potential test to all newly purchased transformers and to all transformers

removed from service before reinstallation.

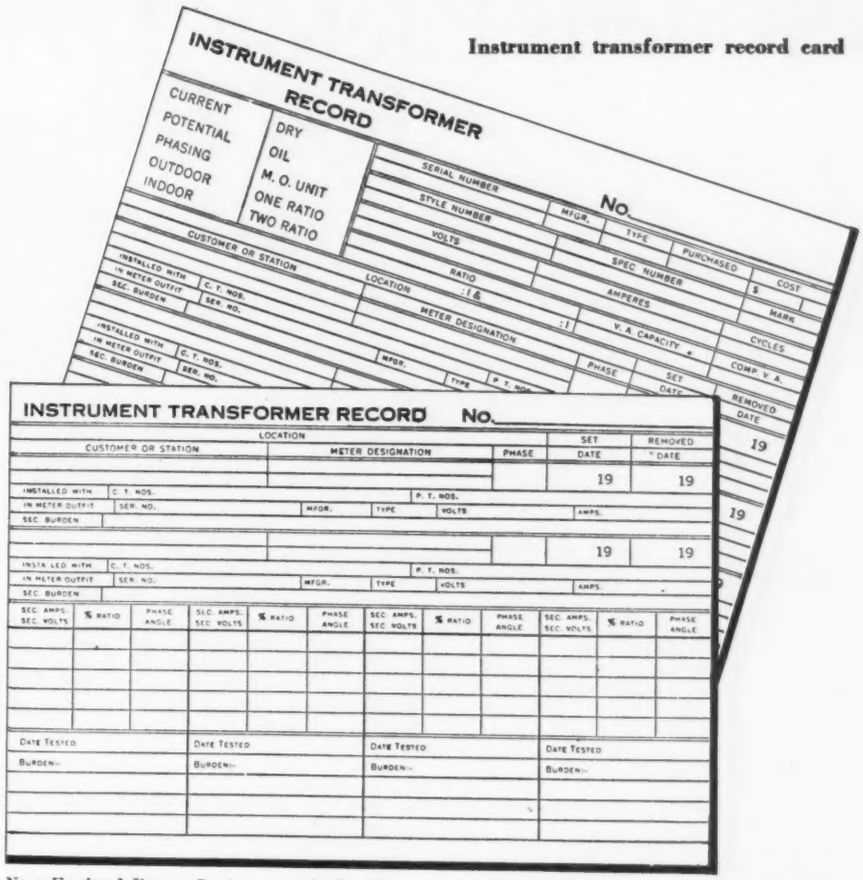
Apparatus necessary for a high-potential test includes one step-up transformer of about 5 kva., secondary 110 volts. The transformer should have a high leakage reactance to protect it against stresses caused by insulation failures. A small 100 per cent buck or boost regulator (about 1 kva.) is very suitable for varying the voltage. If the transformer and regulator are a portable unit, the apparatus becomes much more useful. Such a unit may be used to furnish primary voltage for ratio and phase angle tests of potential transformers and may also be used to control the current supply for ratio and phase angle tests on current transformers through use of a step-down transformer.

The author commended the use of the megger, for check tests of insulation values. This instrument is reasonably accurate, easy to handle, rugged, portable, needs little rechecking and, if properly used, does not puncture or burn insulation. Special attention, however, must be given to megger leads, or readings will include leakage through these. In some cases a high reading may not insure the quality of the insulation, but a low reading is definite indication of defective condition.

Impulse tests, which impose duplicate surges on instrument transformers, are at present confined to manufacturers' laboratories.

Transformers stored at a central point are tested and graded for accuracy and insulation before they are stocked. High potential tests in line with AIEE standards are applied to all new transformers. Transformers from service are tested at 75% of these standards. Since the flood New England Power meggers transformers removed from service before high potential is applied. Current transformers are tested at 0.5, 2.5 and 5 amp. Secondary current value with burden X (2.5 v.a. at 90 per cent power factor) and burden Y (50 v.a. at 50 per cent power factor). Potential transformers are tested at 110 volts secondary voltage at zero burden, full rated burden, at unity and 0.1 power factors. These burdens represent the extremes encountered in practice and the data obtained indicate over-all accuracy. Test data are placed upon instrument transformer record cards, which also carry the installation history as well as data, viz., manufacturer's and company serial numbers, type, date purchased, cost, volts, amperes, ratio.

Instrument transformer record card



New England Power System uses both sides of a 4 x 6-in. card which serves dual types of instruments and carries manufacturer's, utility, customer, installation and test data.

World Water Power Largely Undeveloped

COMPARED with an estimated total of 671,000,000 hp. of potential water power in various parts of the world, the total developed is small, but it has been increasing rapidly, according to a summary published by the U. S. Geological Survey. In 1920 the total installed capacity was 23,000,000 hp. It was 29,000,000 at the end of 1923, 33,000,000 at the end of 1926, 46,000,000 at the end of 1930, 55,000,000 at the end of 1934 and 60,000,000 at the end of 1936, an increase of nearly 160 per cent in 16 years.

The present estimate of potential water power is based on ordinary minimum flow (flow available 95 per cent of the time) and 100 per cent efficiency. Since installed capacity averages two to three times the potential power at low flow at the same sites, it appears that full development of known sites would call for the installation of perhaps 1,500,000,000 hp., of which the present capacity is only 4 per cent. The table shows the developed and potential horsepower by continents.

Developed and Potential Horsepower by Continents

Continent	Developed Hp.	Potential Hp.
Africa	175,000	274,000,000
Asia	5,400,000	148,000,000
Europe	27,200,000	74,000,000
North America	26,000,000	77,000,000
Oceania	600,000	24,000,000
South America	1,100,000	74,000,000
Approx. total	60,000,000	671,000,000

System Factor Terms Too Often Distorted

Terminology of Plant, Utilization, Capacity, Diversity, Responsibility and Load Factors Found Loosely Used in Contracts and Power Analyses

By M. M. SAMUELS

NUMEROUS "factors" are used in power economy analysis, system planning, rates, etc. A review of many papers and numerous discussions reveals the fact that considerable confusion prevails not only in regard to the significance of various factors but also in regard to their meaning. The following discussion is presented as an attempt to clarify the meaning and significance of the factors more commonly used:

Load factor

Load factor is the ratio of the average load to the peak load. It relates either to a customer's load, the load on a power plant or the load on a power system.

The load factor is probably the most used and most abused of all factors. It may be averaged over a month or over a year. It may be based on instantaneous peak, fifteen-minute peak or hourly peak. It is generally based on kw., but sometimes on kva. Thus when the term load factor is used a number of qualifying statements are necessary. Furthermore, the load factor has no relationship to capacity and consequently no relationship to cost.

Load factor can be determined from a load curve without even knowing the scale to which the curve is plotted. Thus the frequently made statements that when a power house operates at a certain load factor the energy costs so much per kilowatt-hour are meaningless. As far as cost analysis of a power house or a power system is concerned, the load factor only assumes a practical meaning when either the energy or the peak with its qualifications as well as the capacity are also known. But when peak, energy and capacity are known the load factor is really not needed for power cost analysis. Therefore the load factor should not be used as indiscriminately as it has been in connection with generation and transmission cost.

Load factor of a customer's load has a practical meaning only when other factors are known. A customer with a high load factor is not necessarily a better customer than one with a lower load factor. The customer with the lower load factor may have his peak at night and it may cost less to serve him than it costs to serve the one with a higher load factor. Here, too, the load factor has no relationship to the installed capacity on the customer's premises nor to the capacity of the utility equipment required to serve the customer. The load factor is an utterly inadequate characterization of the customer's load. Here, too, the peak and its qualifications as well as the energy used must be known, and when these are known the load factor is really not needed for analysis.

Responsibility load factor

Responsibility load factor is the ratio of the average load of a customer to the peak responsibility of that customer.

This term is used only as a characteristic of a load and not as a characteristic of power plants or power systems. It is of greater significance than the load factor, because it relates the load to the system at the time of the system peak.

The customer's peak responsibility is his load at the time of the system peak. Whereas the load factor cannot be greater than unity, the responsibility load factor can exceed unity. Whereas a customer with a high load factor is not necessarily a better customer than one with a lower factor, a customer with a higher responsibility load factor may always be assumed to be a better customer than one with a lower responsibility load factor.

Plant factor

Plant factor is the ratio of the average load to the aggregate rating of generating equipment for a given period.

According to the proposed A.S.A. definitions plant factor and capacity factor have the same meaning except that capacity factor relates to an individual machine and plant factor relates to a whole power plant or a power system. Therefore the plant factor alone will be considered here.

Plant factor relates output to capacity and is a picture of utilization of facilities and of investment. When the annual plant factor of a power house is 25 per cent, it means that on the average throughout the year 25 per cent of the generating capacity operated at full load and 75 per cent was idle, or that 75 per cent of the investment was dead. Whereas the load factor has no relationship to fixed charges, the plant factor establishes the fixed charges per kilowatt-hour. A higher plant factor means a better utilization of generating facilities and lower fixed charges per kilowatt-hour. Load conditions may make a high plant factor impossible or impractical, but the fact remains that the plant factor may be considered by far the most important of all factors in power cost analysis.

Annual plant factor for a power house or a system is:

$$\frac{100 \times \text{kw.-hr.}}{8{,}760 \times \text{kw.}} = \frac{0.0114 \times \text{kw.-hr.}}{\text{kw.}}$$

[*Continued on page* 104]

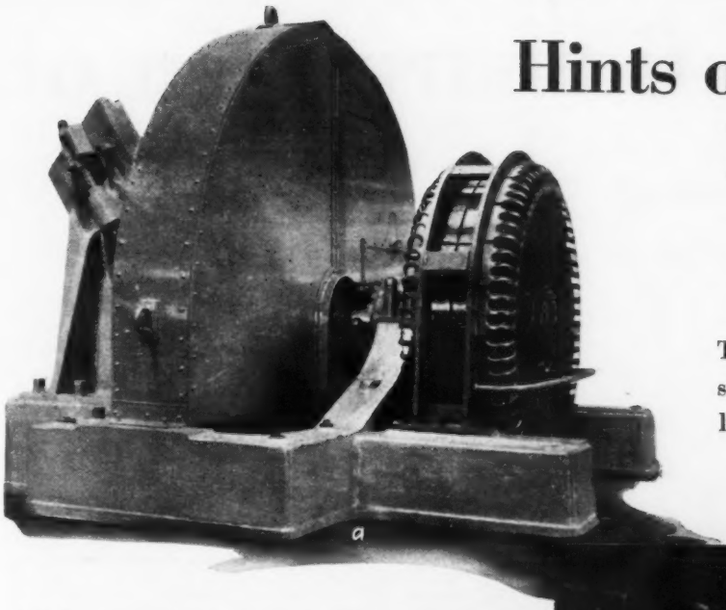
Hints on Selecting Paper Mill Drives

By J. L. RYLANDER . . . M. R. LORY

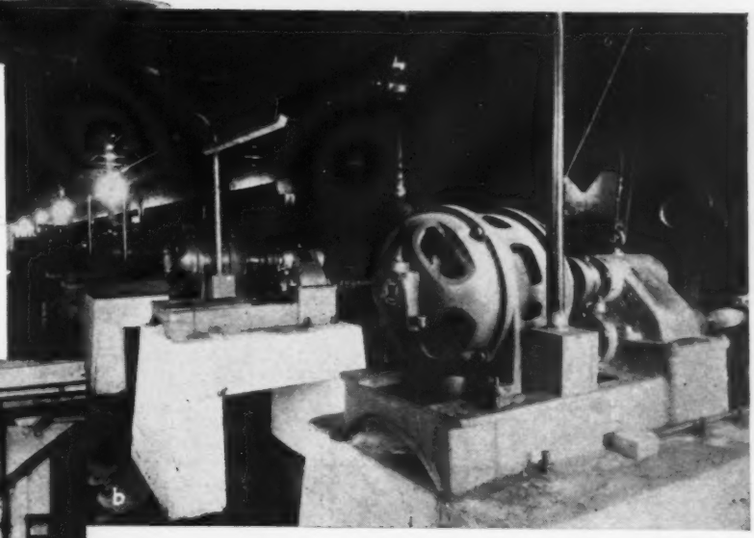
Engineering Division,
Westinghouse Electric & Manufacturing Company *

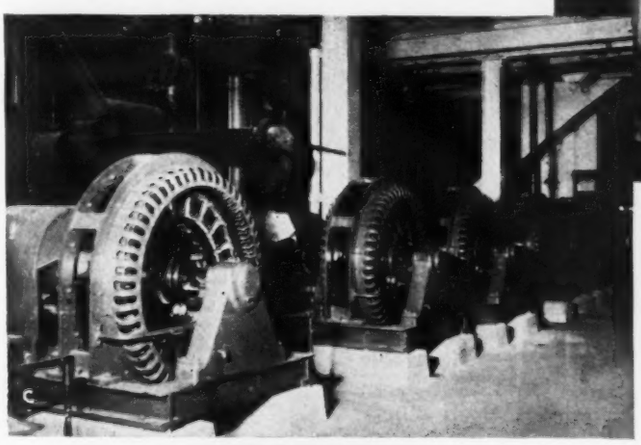
Typical Drives Illustrate Factors to Be Considered in Selecting Motor Design to Fit Peculiarities of Load and Operating Conditions

* Abstracted from paper presented at recent meeting of Technical Association of Pulp and Paper Industry.



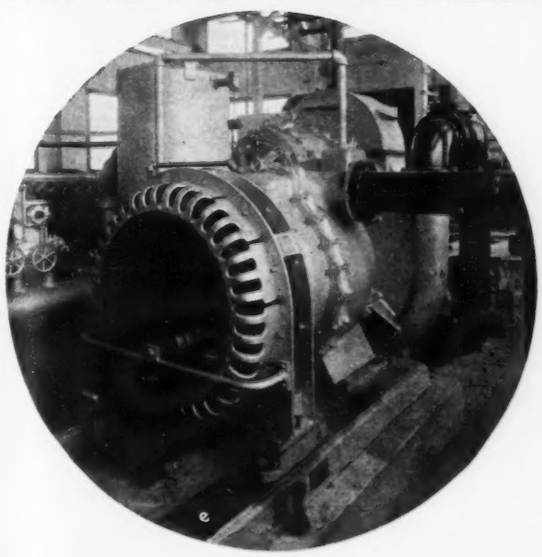
(a) Larger machines in paper mills commonly use synchronous motors in order to keep plant power factor at economical values. Their use is particularly widespread on chippers. Starting as induction motors, these drives must have enough torque to bring the chipper to speed very close to synchronism, otherwise, since the inertia of the load is high, the motor may fail to pull into synchronism in the time available, when the field is applied. A 300-hp., 277-r.p.m. synchronous motor is shown here overhung on the shaft of an 80-in. chipper.





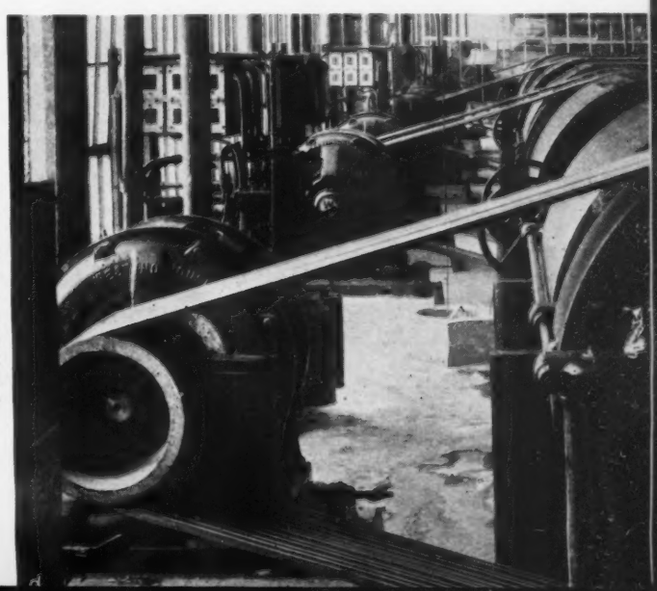
(b) General-purpose motors in small sizes give good service on pumps, agitators, screens, conveyors and other miscellaneous drives around paper mills. Here a number of 20-hp., 1,200-r.p.m. squirrel-cage induction motors are geared to flat screens.

(c) Starting torque requirements of jordans are low and the most important characteristic is the pull-in torque. By special damper winding designs a motor of low inrush and high pull-in torque can be made. Low inrush may permit motors to be started on full voltage when limitations of the power system would not permit this in a motor of standard design. The jordan drives shown are 350-hp., 360-r.p m. synchronous motors.



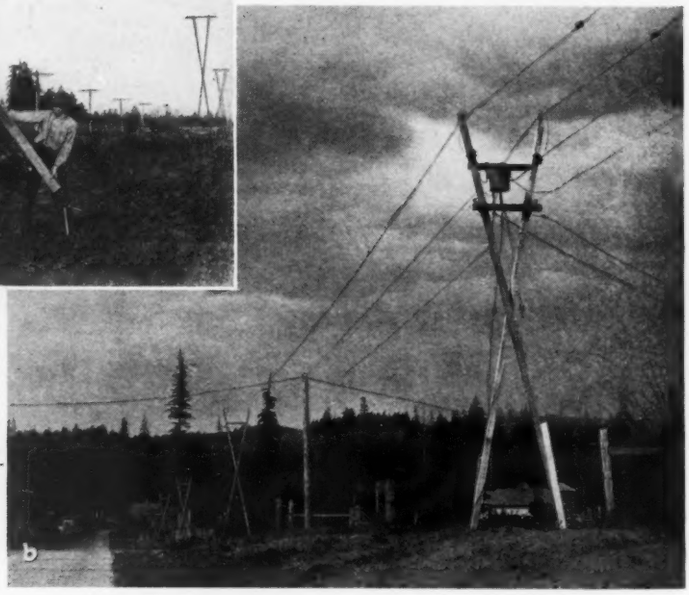
(d) Beaters may be driven by induction or synchronous motors. They require high starting and pull-in torques, and this means high inrush current with synchronous or squirrel-cage motors. Induction motors in the illustration drive the beaters.

(e) 60-hp., engine-type 860-r.p.m. synchronous motor mounted directly on the shaft of a vacuum pump. Torque requirements are higher than standard for low-speed synchronous motors, but sufficient torque is had by making the motor larger.



X-Construction on

By D. S. YOUNG
Yamhill Electric Company, Newberg, Ore.



Up to stay for sixteen years or longer
(a) Two men attach the wires on the ground and then stick the X up on the concrete bases. (b) One of the first is still on the job. (c) They even make them "joint" with telephone.

X-CONSTRUCTION for rural lines, so called from the appearance of the supports, was first used in the early 1920's on the property of the Young Electric Company, a small distributing company buying power wholesale and serving a number of farmers and rural customers in the vicinity of Sherwood, Ore. Now, after sixteen years of experience, in which the design has changed slightly and the size of materials increased, this type of construction is still used in some cases where the load is to be light and where costs have to be kept to a minimum in order to secure the business. The Young Electric Company has in the meantime been absorbed by the Molalla Electric Company, a subsidiary of Portland General Electric Company.

The supports in this X-construction are made from standard, high-grade lumber, or in some cases round poles, by bolting these members near the center in the form of an "X," attaching a crossarm across the top and bolting the bottom of the members to pipes or angle irons imbedded in concrete bases. This design gives a balanced type of construction supported on concrete and pivoted at two points instead of one, as in the ordinary pole construction. Its flexibility allows it to adjust itself automatically to any unusual conditions of physical load and the design permits the use of materials of any size necessary to meet these loads. Being built up of several individual parts, the units are light and easy to store and handle.

Originally 2x4's 20 to 22 ft. long were used. Later the design was changed to use 3x4's or 4x4's, 26 to 30 ft. long. On the original 2x4 lines light extension ladders were used for climbing. When heavier lumber is used linemen climb with hooks. Originally the concrete bases were cast in forms in some central locality and delivered to the holes, but now it has been found that casting the bases directly in the holes on the job provides a better foundation at lower cost. The frame is held above the level of the ground by a pipe or angle iron, and thus rotting of the wood at the ground line, as in the case of buried poles, is eliminated.

Practically all the work in building this type of line is done on the ground, even to tying in the conductor wires and guys on the supports before they are raised. With 26-ft. tall X-lines, equal in height to the standard line on 30-ft. poles, three men make a crew. Such a line is easily built without power equipment.

The cost of a two-wire line of No. 6 hard-drawn copper, using 26-ft. 4x4 members and 225-ft. spans, has run from $325 to $350 per mile, exclusive of transformers, secondaries, meters

George Kable in the ELECTRICAL WORLD *of May 19, 1928, first brought this tale out of the Northwest. Regardless of skepticism, the lines are staying up and with an annual maintenance cost of 1.4 cents per X-frame, and the decimal point is in the right place.*

Rural Power Lines

Portland Subsidiary, After Sixteen Years, Finds Construction Easy, Costs Low and the Performance Gratifying

and service drops. Tests have shown that 26-ft. X-frames will stand a pull at the top of from 700 lb. to 1,100 lb. before breaking. The National Safety Code gives the transverse load on a three-wire No. 6 copper primary line with 200-ft. spans under heavy loading conditions as 750 lb., and with 150-ft. spans as 460 lb.

When something happens to break both wires, as for instance a tree falling across the line, the line will fall if it is not protected by "breakers," but it is easily rebuilt, taking about fifteen minutes for each support that is down. However, the use of "breakers" minimizes the possibility of such accidents. The "breaker" is made up of a weak link of wire so placed that it carries the main line tension. This link breaks before the main line is injured, thus opening the circuit, and a stop cable keeps the X-frames from falling. Repairs are easily made by simply restretching the line and tying in a new breaker.

Maintenance records, collected over the last fourteen years, covering the cost of labor and material of all repairs to lines in service, indicate an average maintenance cost of 1.4 cents per X-frame per year. Only one support per year for every 238 in service has been on the ground from all causes such as trees, storms, automobiles, trucks or road equipment. Fourteen years' service has failed to make any inroad whatever on the untreated lumber used in the X-frames. It seems safe to expect a life for these supports of 25 to 30 years. Creosoting, at a cost of about $1.65 per X-frame and cross arm, would undoubtedly extend the life of these supports materially.

Fixed in fifteen minutes

(a) Easy to repair. No repairs to the driver who did it. (b) Tree on the line just makes the X lean.

When they do have to be replaced rebuilding will require only lumber and the labor of placing it. There will be no labor required for hole digging, since the same concrete bases, which are practically indestructible, will be used.

Electrification of Farms Varies Widely

More than half the farms in New England and three-fourths of those in the Pacific States now have electric service, if the ratio is computed on the basis of the number of farms that have dwellings valued at $500 or more, according to statistics recently published by the Edison Electric Institute. Although the fraction is smaller in other sections of the country, on the same basis the national average exceeds 23 per cent. Farm homes having dwellings valued at less than the small amount mentioned are scarcely to be considered as prospects for electric service. If these are included, the saturation amounts to 16.8 per cent.

Number of Farm Customers and Per Cent Electrification

(A) referred to all farms having occupied dwellings.

(B) referred to farms having dwellings valued at over $500.

Region	Number of Farms Served (Dec., 1936)	Per Cent Electrification (A)	(B)
United States	1,042,924	16.0	23.7
New England..	78,691	51.7	54.7
Middle Atlantic	164,998	42.4	44.3
E. No. Central	268,472	25.4	27.9
W. No. Central	106,767	9.4	10.8
So. Atlantic....	97,245	9.0	16.3
E. So. Central	50,540	4.7	11.8
W. So. Central	44,819	4.1	8.8
Mountain.....	59,404	23.1	34.1
Pacific.....	171,988	61.5	74.1

Ranking states under the former category and their percentages are: Rhode Island, 93.2; California, 90.5; Utah, 79.3. At the other end of the list are North Dakota, 3.6; South Dakota, 4.6; Arkansas, 6.4; Oklahoma 7.2; Mississippi, 7.4.

Farm electrification is far advanced in the populous East, the only part of the United States comparable with the major European countries, and on the Pacific Coast, where power is needed for irrigation. The ratios are low where farmsteads are far apart and the investment would be prohibitive.

Editorials

TVA-Arkansas Power Contract

MANY are the speculations that have arisen since TVA announced last week that it had made a five-year contract to sell power to Arkansas Power & Light Company. This is the first contract to sell TVA power to a private utility since the contract with Commonwealth & Southern was allowed to lapse this spring and it is the first time that TVA power will cross the Mississippi.

While the contract has been made at the standard TVA rates for wholesale power to municipals and cooperatives, it does not contain any "yardstick" requirement specifying the rates at which this power will be resold to the consumer. The announcement merely stated that the company had "indicated its intention of reducing rates in Arkansas" with the beginning of the service of the contract.

Does this mean the abandonment of the "yardstick" principle, for surely TVA cannot expect to impose such restrictions in one place and not in another?

Since there is reason to believe that TVA for several years will lack sufficient firm power to carry Memphis, Knoxville and Chattanooga in addition to its present load the provision that the two parties to the contract will furnish each other standby service in case of emergency is of more than passing significance.

While the rates for this TVA power are higher than it would cost utilities to generate an equal amount of power by steam, fair contracts can be of mutual advantage to both parties. The utilities as a matter of public policy are willing to help the government dispose of this power, but not in such a way as to destroy their investment. Power companies much nearer to the source of TVA power than Arkansas have stated that they would be willing to contract to buy such power provided they had the assurance that TVA would not compete in the area in which such power was being used.

However, the personnel of the TVA board remains unchanged, as does the point of view of Senator Norris and Representative Rankin. With that in mind as well as the standby clause, there does not, at the moment at least, appear to be sufficient cause to believe that this contract is any indication of a change in policy with respect to TVA's attitude toward private utilities.

Energy Production Reflects Widespread Strike Influence

EVER a sensitive indicator of trends of industrial activity, electrical energy production is reflecting the widespread adverse influence of the break-down of labor relations in the strike-stricken areas.

The early months of the year gave good promise; the decrease in energy output from the highest week in January to the lowest in spring was no greater than in 1935 and 1936. In each instance this was followed by a rise, but the upward trend this year has been less vigorous than in the preceding two. By the third week in June, 1935, the output had risen to equal the January maximum. In 1936 there was an increase of 50,000,000 kw.-hr. This year the June week fell short, by an equal amount.

In the Central industrial area, where the disturbances have been most severe, the excess over 1936 has decreased from 20 per cent, or better, in March to 12.2 per cent in the third June week. In the South it dropped from 19 to 13 per cent. In the Rocky Mountain states, heavy consumers of energy for mining, the repercussions of the shock to industries elsewhere were felt in an abrupt decrease from 28 to 13 per cent in the rate of gain.

Kilowatt-hours, however, are merely the instantaneously responsive measure of demands that indicate how far beyond the immediate battleground the losses extend. Thus the steel strike affects not only the suppliers of that industry but those who depend upon them for business, and on and on. When business and the public are made to appreciate this condition, then, perhaps, government will be less enamored of the votes of certain groups of organized labor.

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Independence of Power Plants

MANY of our large power systems receive their energy from several central stations which are interconnected by the network of the distribution system and frequently by direct tie lines. It was the practice in the design of some of the older stations to make each plant an independent unit capable of starting up and operating independently of other stations. Certain essential steam-driven auxiliaries or a steam-driven house unit were provided for such starting up. These stations therefore functioned as independent units.

Introduction of electric motors for auxiliary drive led to the use for auxiliary service of house transformers and house generators which derived their energy from the main turbo-generator units. The steam-driven auxiliary was often limited to the boiler feed pump. No steam-driven house turbo-generator was included. When such a plant is started up energy supply for

firing equipment, forced and induced draft fans, condenser circulating and condensate pumps is taken from other stations through the interconnections. Normally, this meets all system requirements. But there still exists that possible contingency of failure of the interconnection. Should such a failure occur that would deprive the station of voltage for a short period, the station would go out of service and could not start again without energy supplied from outside.

The house turbo-generator's chief fault is that it requires steam pressure to start. If the plant happens to have no steam pressure at the time of the emergency, it may not be possible to generate steam without the operation of auxiliaries. The house turbine therefore does not meet all requirements for an ideal emergency source of auxiliary power.

At first blush it may sound like heresy to suggest the use of a Diesel-driven house unit in a steam plant, yet such equipment may be found to more nearly fill the need of assuring a reliable and independent source of auxiliary power supply in any contingency.

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Vale Tri-County Farm Line Dream?

THE Massachusetts commission's recent unanimous decision against the gangling Tri-County rural electrification project which planned to build about 230 miles of line in a dozen different localities with the aid of about a quarter of a million REA dollars and $25,000 in company stock deserves to be heeded by all supporters of sound electrical development.

Thorough investigation by the board and its technical staff, including public hearings, led to the vigorous conclusion that the proposed capital, if, when and as paid in, is decidedly inadequate to provide service of the standards required in the Bay State, and that the proposed note and mortgage arrangement by which the Tri-County company assumes burdensome obligations is "improvident, and unwarranted by any rational calculations based upon prevailing conditions" . . . and that "to approve an imaginative proposal under the conditions would naturally, we believe, result in failure." The costs were clearly underestimated, and the revenue anticipated from the two to three customers per mile averaged by assuming that from 450 customers up would be obtained was equally in doubt. The uncertainty of future federal foreclosure in the event of insolvency was a major deterrent to the commission's approval.

State utility commissioners are appointed to protect the public interest. Whether the electric service is to be furnished by a private utility, a municipal plant or a co-operative, the public interest still remains. REA has repeatedly taken the position that a co-operative, because it was a non-profit venture, should not be subjected to state commission regulation. Surely, the Tri-County case is sufficient evidence of the need for local commission scrutiny of co-operative as well as private projects.

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The Engineer's Protest Against Economic Crime

MONSTROUS economic crimes have been committed by government in the bewildered scramble to spend thick slices of everybody's income to improve the living standards of the underprivileged classes. The engineer generally is rarin' to go with a crusade to reduce these political ventures to a plane of sensible economy, but he is not vocal. And so a few engineers are agitating to thrust the American Institute of Electrical Engineers into the fray, out in front, carrying the banner of sense in public works planning and spending.

Dean Bush in his masterly address at the A.I.E.E. convention last week admitted the Institute would probably be disrupted if it should try to agree on any policy of refutation or exposition of fallacies in governmental engineering measures. He proposed, on the contrary, an elder-statesman board whose professional prestige would compel respect and attention on engineering ventures of broad public import. Further, he urged that the government retain engineering consultants to advise on the politically advocated enterprises.

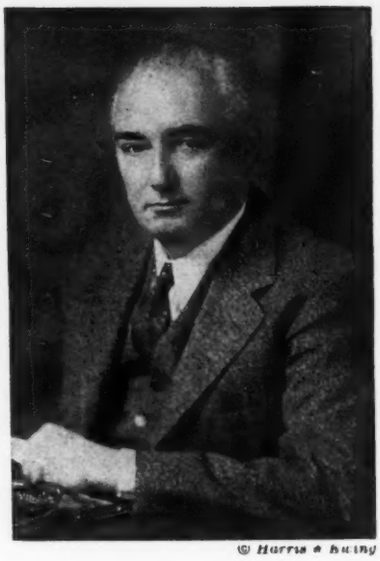
Well, maybe there was a period in the evolution of our democracy when politicians would bow to a self-constituted engineering supreme court, and such a time may come again. But, at the moment, the administration that is yanking us toward economic bliss at a billion dollars an inch is moving heaven and hell to eradicate the only existing and time-honored check to its futile squanderings.

No matter how broadly supported by the engineering profession, such a board of counsel would be repudiated, or ignored the moment it attempted to thwart some new proposal to save the country by submerging another valley with dammed water for power.

The engineer, however, does have a chance and a duty to be vocal. He can elevate the profession as a factor in civic service by making sure of his facts, becoming effective in presenting them, and then, at every opportunity, telling the public how sadly it has been deluded by conniving reformers. From a multitude of such individual efforts will come a mass movement of engineers which would be impossible now. There are dozens of issues on which a befuddled and unorganized middle-class electorate is yearning for an escape from lunacy and futility. Think what a hundred thousand engineers could do by simply telling their neighbors the simple facts about water power, flood control and navigation.

The Joker in the Seven TVAs Bills

By CARTER FIELD



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This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him

SENATOR GEORGE W. NORRIS deplores the idea that his "Seven TVAs" is a power wolf in navigation and flood control sheep's clothing, but adds that it would be an "economic sin" not to use power once the dams are constructed for other reasons!

Actually it is not so much the language of the proposed bills—either the drastic one of Senator Norris or the milder one of Representative Mansfield—as it is what *could* be done under the powers proposed.

It is practically certain that this legislation will not pass at this session of Congress, even if adjournment is delayed, as now seems probable, until some time this fall. But it is also practically certain that some combination of the Norris and Mansfield bills will be passed next year.

So that the differences between the two bills, and the possibilities of change, become of enormous interest to the electrical industry—and to the taxpayers.

Something of this nature became inevitable the day President Roosevelt and Senator Norris conferred on the Supreme Court enlargement bill. It will be recalled that Norris had devastated the White House by a quoted comment that of course packing the Supreme Court would not be enough to accomplish the President's objectives—that a constitutional amendment also would be necessary.

It is difficult to exaggerate the importance of this simple statement of *that* stage of the controversy. The President's contention rested firmly on the foundation that it would take too long to get a constitutional amendment adopted—hence the court packing program was vital. Norris is renowned on Capitol Hill not only as a baiter of the electric industry but as a constitutional lawyer of parts. And for being one of the most stubborn of men, once he takes a position.

Hence it was vital for the White House to check this insidious undermining of the President's case by the Nebraska Senator without delay. It so happened that Norris called at the White House immediately thereafter about his seven TVAs proposal. He emerged after a long time, all smiles, announcing that his latest pet measure was sure to go through. Since then he has been a strong, though not loquacious, supporter of the court program.

Not long thereafter, however, came the Mansfield bill, obviously with the President's blessing, but not going anything like as far as the Norris measure, if one assumes that there is no intention to deceive.

The Mansfield bill purports to be concerned chiefly with water projects, primarily navigation and flood control. It provides for regional directors, who are to serve as liaison officers between state and federal authorities in making plans for water development. Whereas the Norris bill sets up "Authorities"—that formidable title which so far has not exaggerated the functions of those appointed to them. One Authority is proposed for each of the seven regions of the country. The Authorities are set up just as TVA was set up.

Now of course actually the bill does not really grant power to these Authorities to do anything they please—to build dams and operate power plants, for instance. But neither did the TVA act. It is a question of the men who are appointed to these Authorities, of course, what they will recommend, and how far their actions may commit the government. It is a question of what the administration appointing them wants them to do. And it is a question of whether Congress will vote money and authorizations to carry out their recommendations, once these are approved by the President.

Now it is perfectly true that the one man directorships which would be set up by the Mansfield bill could function in precisely the same way. More machinery could be added later once recommendations had been made and money voted to carry them out.

But it is also rather obvious that the President did not discourage Senator Norris to an extent worth mentioning in that talk, after which Norris announced that the seven TVAs bill was on the agenda, and since then he has made no sniping remarks about the Supreme Court enlargement bill.

What close friends of the Nebraska Senator say happened is that the President told Norris he could not openly approve going as far as Norris wished—that therefore he would be compelled to indorse another bill—but that he would have no objection to Norris introducing just the sort of bill the Senator wanted, and that the President would not move a hand to prevent the Norris bill from being substituted for the Mansfield bill if Norris could muster the votes.

It's Roosevelt's old favorite strategic position of being in between—of having his enemies on one side frightened more of the extremists on the other than of Roosevelt himself, and consequently acquiring a substantial element of support from both sides.

But nobody should be deceived. In this case Roosevelt is not *actually* in the middle at all. He is in Senator Norris' corner so far as the electric power issue is concerned.

News OF THE WEEK

TVA and Arkansas Power & Light Sign Contract for Surplus Power

Pact for five years can be terminated by either party on notice of 2½ years — Sale of surplus energy to net government agency $750,000 annually after five years — Rankin wants yardstick rates

In an effort to gain a market for the tremendous amount of electric power to be generated at its gigantic hydroelectric development and to obtain some revenue to give a semblance of self-sustaining operations, the Tennessee Valley Authority last week signed a contract with the Arkansas Power & Light Company covering the sale of surplus power produced by the government power experiment for a period of five years.

The contract with the Arkansas utility, a subsidiary of Electric Power & Light Corporation, affiliate of Electric Bond & Share, provides for the sale of 10,000 kw. of firm power during the first year and ranges to a maximum of 35,000 kw. of firm power at the end of five years.

Contract renewable

The contract renews itself automatically from year to year, after five years, unless terminated by either party on 2½ years notice. It provides for gradually increasing sales and payments, and it is estimated that at the end of the fifth year, and in succeeding years, the annual revenue to TVA will be approximately $750,000.

Sale of firm, interruptible and run-of-stream secondary power is provided in the contract. Sale of 10,000 kw. of interruptible power is provided in the first year; 30,000 kw., half firm and half interruptible in the next year. In the third year the total is increased to 40,000 kw., divided half firm and half interruptible. In the fourth and fifth years the total demand is continued at 40,000 kw., but the percentage of interruptible power declines, and if the contract continues after five years, it will be on the basis of the sale of 35,000 kw. of firm power, no interruptible power and 5,000 kw. of run-of-stream secondary power.

Regular TVA rates

The rates for firm power to the Arkansas utility are the regular TVA wholesale rates as applicable to municipalities and co-operatives. The rates for the other classes of power are the regular TVA rates.

The contract, which was executed by Harvey C. Couch, president of Arkansas Power & Light, and David E. Lilienthal, TVA power director, contains no provision for resale rates of the power. The contract becomes effective upon approval of the Federal Power Commission and the Arkansas Public Utilities Commission.

Delivery of the power will be over the 154,000-volt line now being constructed by the TVA between Pickwick Landing Dam and Memphis. Power will be delivered at a substation near Memphis. All power sold to the utility, beginning this fall, is for distribution in Arkansas over the company's lines. The contract provides reciprocal standby service.

This is the first TVA contract with a private utility since negotiations with Commonwealth & Southern properties were abandoned.

Representative Rankin, Dem., Miss., said that he hoped the contract will be "of the shortest period of duration possible" and require the utility to resell the power at TVA yardstick rates.

"Unless this power is resold at the yardstick rates," Mr Rankin said, "this will be the last contract of its kind ever made by the TVA with a private power company, if I can have my way."

Utilities Win Point in TVA Suit

Efforts of the TVA to compel nineteen utility companies to define more clearly the issues on which they will attack the legality of the government power agency to compete with private industry were lost this week. J. L. Fly, TVA counsel, asked Judge John J. Gore to strike out several sections of the original bill which the utilities considered pertinent to their case, but the court declined.

Regarding statements of President Roosevelt made in his 1936 campaign addresses, Judge Gore held that "in deference to the Chief Executive and the office which he holds I believe statements he made in political speeches should be excluded. If the TVA has exceeded the powers granted by the Act of Congress he is not conscious of it."

Mr. Fly argued in his motion that "there is a suggestion that the government must be prepared to withstand any kind of attack. We are in darkness as to the particular issues which are to be tried." Judge Gore held that "every allegation I have allowed to remain in the bill is pertinent."

The motion of the TVA to have the power companies file a bill of particulars was overruled by the court, Judge Gore declaring that such action would force them to submit evidence in advance.

The rate question, which became a heated argument between Mr. Fly and Ray Jackson, law partner of Newton D. Baker, was allowed to stand, Judge Gore allowing it, declaring he was unable to see how their inclusion would injure the defendant.

Wants copies of contract

Seeking to have the utilities produce their charges, Mr. Fly said that "I want copies of those rights, powers and franchises necessary under the laws of the state in which they do business." Judge Gore asked: "Do you think it would be fair to force them to let you read their franchises and see when their contracts expire?"

Judge Gore expressed the hope that nothing would prevent the case going to trial on a "fair and square basis" in the fall in Nashville. He appointed Hall Clements of Knoxville as special master to take dispositions in the case.

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Polk-Burnett Power District Declared Invalid By Court

The Polk-Burnett power district has been declared invalid in a decision of the Wisconsin Supreme Court. The district originally included 28 municipalities and in this form was approved by the state public service commission, with certain restrictions as to its economic feasibility. At a referendum in August 1935, seven of the communities voted not to join the district.

Chief Justice Marvin B. Rosenberry ruled that the public service commission had not "fulfilled its statutory duty" in that it had not made a further determination of the economic feasibility of the district after the election had reduced the number of municipalities.

•

Wrong Company Named

In the June 19 issue of ELECTRICAL WORLD mention was made that Richard J. Beamish of the Pennsylvania Public Utility Commission had served notice on Madison Power & Light Company of York that he would recommend imposition of new temporary rates. The company was the Edison Light & Power.

Bay State Rural Project Killed by Public Utilities Commission

Massachusetts body finds financial set-up inadequate, costs uncertain and revenues nebulous — Tri-County Electric was to use $255,000 REA loan as basis of financing — Competition would raise costs

A resounding adverse opinion by the full membership of the Massachusetts Department of Public Utilities was handed down last week upon the Tri-County Electric Company's rural electrification project, embracing some 232 miles of line planned to take a wandering course over the western part of the state, with Greenfield as a nucleus, and with an REA mortgage loan of about $255,000 maximum as the basis of financing.

The company was organized as a co-operative project with a par value of stock set at $25,000 to be raised locally, which its supporters claimed would suffice to maintain and service the system. Energy was to be purchased from existing private companies and the estimated cost of construction was about $1,100 per mile of line. At the hearings it was brought out that twelve sections would probably comprise the system and that the customer density would range between two and three per mile.

Meager capital

The commission held that $25,000 is meager capital, falling far short of the necessities of the situation, and that no thought of reasonable reserves for operating emergencies in the mountainous terrain involved seems to have entered the minds of those back of the petition. Electricity purchased would have to be paid for before bills can be collected.

Such a company, "mortgaged to the limit," in the board's words, might be expected to have difficulty in borrowing money from banking sources, and if at all, only at a high rate of interest. "What is more disturbing," the decision stated, "is the element of extreme vagueness and uncertainty that surrounds estimates of anticipated revenue and cost of operation of the new company. The financial ability of customers to pay high electric rates if necessary, to advance additional capital, or to make further sacrifices, is not known. These unascertained or unknown facts, together with the apparent lack of experienced management, leads to the belief that future financial success is to be left largely in the lap of favorable chance . . . the department is not unsympathetic with any program to assist rural communities and the farmer to obtain modern electrical conveniences . . . but it cannot shut its eyes to facts . . . ordinarily, adequate data are accessible (but not here) . . . "

Territory now served

The opinion pointed out further that in the territory involved by the project six existing private companies, with $8,424,000 of paid-in capital and 14,761 customers in the 28 towns concerned, are now in operation, and that statutory provision exists under which any aggrieved prospective customer can seek to be served through suitable adjudication by the commission.

Experience has shown, the board stated, that competition in the electric field tends to increase the cost of serving the public and perhaps cause other serious inconveniences. The board does not consider its province to include finding out from each town in advance its inclinations toward such a project. In conclusion it stated in part: "The proposed capital, when, as and if paid in, is decidedly inadequate to operate the electric business as outlined in conformity with the standards of effectiveness as required by our regulatory laws; that the proposed note and mortgage arrangement, by which the company assumes burdensome obligations, is improvident, and unwarranted by any rational calculations based upon prevailing conditions . . . to approve an imaginative proposal under the conditions stated at the hearing would naturally, we believe in the end, result in failure."

Harry E. Duren, vice-president Western Massachusetts Electric Company, declared that economic rural line development, held in abeyance out of consideration for the Tri-County project, will now be pushed rapidly forward in an attempt to take up the slack in construction, normally about 25 miles of new line annually.

Engineering Professions Urged to Take Part in Public Affairs

Sentiment at Milwaukee A.I.E.E. meeting favors some discreet form of advisory or consulting capacity to prevent uneconomic commitments of government in technical field — Opposition expressed

Integration of engineering professions in order that they may exert strong wholesome influence on government was urged by Vannevar Bush, dean of engineering at Massachusetts Institute of Technology, upon the American Institute of Electrical Engineers at the convention last week in Milwaukee.

The convention listened also to an equally classical address by Ralph E. Flanders, chairman of the engineering economics committee of American Engineering Council. Unfortunately, however, neither offered a specific and immediately practicable solution to the problem from the associational standpoint.

Doing superior job

The Council is doing a superior job, Dr. Flanders said, but admitted that there were many governmental activities upon which its advice was not sought and no way existed to register the sound opinion of the engineering profession upon such matters of primarily technical import.

Dean Bush implied many of the current enterprises of government constitute "a foolish piece of work in any language." To avert further uneconomic commitments he offered two proposals. First he suggested a sort of elder-statesman board to advise government on engineering matters. Further he proposed that a considerable measure of the reliance of government upon the engineering profession should be placed through a consulting relationship with appropriate fees paid to competent and authoritative members of the engineering profession.

Former president A. W. Berresford advocated more attention in programs of local sections to discussions of public matters, citing the engineering society of Milwaukee, the host city, as an outstanding example of what could be accomplished.

L. A. Doggett gave a statistical analysis of A.I.E.E. papers of broad public incidence, ending with the suggestion of the establishment of a national power policy committee of the Institute.

Seeks Institute's opinion

F. R. Innes of Chicago pleaded for a census of Institute opinion on such a specific issue as the proposed seven-area replicas of TVA, but no action at the meeting was permitted by Chairman L. W. W. Morrow.

Mark Eldredge reviewed the scope of the Institute's technical committees and suggested greater attention to papers that show the wide-reaching effects of specific engineering achievements on social and national progress.

The keynote which synthesized the conservative sentiment, which has guided the Institute in the past, was offered by J. B. Whitehead, another past-president. He insisted the society should be careful to avoid any expression of opinion, in the name of the Institute, on public questions of a controversial nature.

And there the matter remains, even though some of the delegates and others argued the matter in an improvised second session whose fervor had to compete with the equally mercurial disposition of the weather.

The technical deliberations are reported in an extensive article in another section of this issue.

Planning the Pacific Coast convention to be held in Spokane, Wash., August 30 to September 3, are C. E. Rogers, Pacific Telephone & Telegraph, vice-president Section No. 9; C. S. Rich, headquarters, A.I.E.E.; H. V. Carpenter, Washington State College; M. F. Hatch, Washington Water Power, chairman Spokane Section; H S. Osborne, American Telephone & Telegraph, chairman technical program committee, and S. E. Caldwell, Pacific Power & Light, secretary District No. 9

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Ontario Signs Pact With Abitibi Power

The Ontario Government has signed an agreement with the Abitibi Power & Paper Company settling all claims and matters in dispute between the province, the Hydro-Electric Commission and the utility. The agreement reallocates the timber limits and pulp concessions of the company and clears the way for re-organization.

The four-point agreement provides, among other things, that the company must have its long idle plants at Espanola and Sturgeon Falls in production, whole or in part, by 1940, or its assets in these enterprises — timber limits, power and other operating rights —must be put up for sale.

The Ontario Hydro-Electric Commission will acquire the utility's Crystal Falls power development in lieu of indebtedness to the province for timber dues and other obligations. Power from the Crystal Falls project will be used in Sudbury, the commission already having the necessary transmission lines under construction.

•

Bonneville Power Measure Passes House Committee

Under the terms of the Bonneville power bill, formally approved by the House rivers and harbors committee recently, the War Department will operate the dams, locks and power house. Distribution and sale of the generated power will be handled by

an administrator named by the Secretary of the Interior.

While the Federal Power Commission was given authority to pass on rates, a last minute revision of the bill denied the commission the authority to establish a uniform interest rate on all federal projects for the purpose of amortizing costs. Instead, interest rates are to be fixed for the individual projects.

•

F.P.C. Shows Electric Rate Cuts by Utilities

The Federal Power Commission declared this week that rate reductions were made in 1935 by 95 utilities, or 61.3 per cent of the total number serving 132 cities in the United States. Residential consumers in 126 cities, 66 per cent of the total covered by the report, had lower bills on January 1, 1936, than at the beginning of the previous year.

Discussing the trend of utilities toward simplification and uniformity of rate schedules, the commission stated that "it is evident from the new residential rate schedules and changed rate structures that material progress is being made in the direction of simpler and more uniform rate schedules." It was stated that it appears to be a definite trend toward the grouping of most of the residential services under one rate schedule instead of the former method of applying different schedules to different types of service.

Objective rate plans which offer lower rates to customers who increase their consumption over that of the corresponding month of a previous year appears to be gaining a wider application than heretofore, the commission stated. It was also found that rate increases were rare while reductions were general throughout the country during the period from October 1, 1924, to July 1, 1936.

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Circuit Breakers Contract

Westinghouse Electric & Manufacturing Company has tendered low bid and is scheduled to secure award for outdoor-type oil circuit breakers for power project of the Colorado River Authority, Austin, Tex., at Dams Nos. 1 and 2, Colorado River, at a price of $39,490.

Hugh L. Cooper Dies; Was Pioneer Engineer

Colonel Hugh L. Cooper, pioneer hydro-electric engineer who designed and supervised the construction of Wilson Dam at Muscle Shoals and the Dnieprostroy Dam and power station in Russia, died of arteriosclerosis June 24 at his home in Stamford, Conn., after an illness of three weeks. He was 72 years of age.

One of the nation's outstanding authorities in hydraulic engineering as applied to power development, Mr. Cooper in the past 45 years had designed projects producing more than 2,000,000 hp. and costing $200,000,-

Blank & Stoller

000 in the United States, Canada, Soviet Russia, Chile, Mexico and Egypt.

The Dnieprostroy Dam in the Ukraine was the world's largest until Boulder Dam was completed. The project got under way in 1927 and Colonel Cooper was placed in full charge. He stayed in Russia six years and at the completion of the project he received the order of the Red Banner, one of the highest decorations bestowed by the Soviet Government.

Colonel Cooper was born in Sheldon, Minn., in 1865. At the time he chose hydro-electric engineering as his profession, the making of electricity had just recently begun and he was among the few far-sighted men who saw that rivers could be put directly to work generating electricity.

His first job to attract national attention was the damming of the Mississippi River at Keokuk, Ia. This project marked a change in hydro-electric practice, for up to that time men had thought of water power mostly in terms of narrow, rapid rivers. From the standpoint of engineering and economics the Keokuk Dam was a demonstration that the great water-power projects of the future need not hunt new Niagaras.

Other important works supervised by Colonel Cooper include the Toronto Power Company's plants at Niagara Falls and the Pennsylvania Water & Power Company's plant at Holtwood, Pa. The Muscle Shoals project he supervised totaled 620,000 hp. Colonel Cooper was president of Hugh L. Cooper & Company, Inc., New York.

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Meter Racket Exposed by New York Utility

A six-year search to uncover a clever and profitable racket, which saved large electric customers thousands of dollars a year, was revealed this week in New York when Walter Laurence, Jr., was held in $5,000 bail in Yorkville Court.

Consolidated Edison Company of New York, Inc., estimated that it lost about $1,000,000 a year through the scheme of turning back meters. John J. Holland, chief of the property protection department of the utility, declared that the company had watched the racket develop for twenty years, but that it had been impossible to get enough evidence for an important arrest.

It was pointed out by Mr. Holland that clever counterfeit seals were made to replace the broken company seals. Shunts and other methods uncovered were considered crude to the one employing counterfeit seals.

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Kelvinator Plant Reopens

Kelvinator division of Nash-Kelvinator Corporation resumed operations this week, following satisfactory adjustments of differences between management and workers which closed the plant June 10. Statement by the company said in part that "Kelvinator has in the past, and will in the future, continue to maintain a scale of wages and working hours that compare favorably with those prevailing in Detroit."

A summer sales program involving double the amount of advertising used last season in conjunction with a radio contest and better terms for installment buying will start immediately.

Commonwealth Edison Makes Voltage Change

Commonwealth Edison Company has undertaken the change in its service voltage for the Chicago area from the level of 115 volts to the standard of 120, toward which lamp manufacturers and utilities have been working for some time. The company expects to accomplish the change in pressure in five one-volt steps over a period of ten months. The change was started about the middle of March, shortly after authorization had been granted by the Illinois Commerce Commission.

With the introduction of the secondary network into the system several years ago, it had been expected that eventually the service voltage would have to be changed. In the direct current service area, changing the voltage is simply a matter of adjusting field excitation, it was said. However, in the alternating current area, compensators on some 600 circuits must be reset.

The first phase of the work was completed in May and the second adjustment of one-volt is now under way. By this procedure, it was said, there will never be more than one-volt difference between normal service voltages at any time. The complete change will be accomplished quite imperceptibly, it was said.

In its free lamp renewal service, the company began to use 120-volt lamps exclusively the first of June. At that time customers who purchased lamps from other suppliers were notified that lamps of the new voltage rating should be secured. Lamp manufacturers at the time ceased to supply 115-volt lamps in Chicago.

It is expected that the change will be so gradual over a comparatively long time that no service inconvenience will be felt by customers. The move is to insure better service to all customers as regards voltage regulation and lamp performance.

•

Lynn Vacations Staggered

About 5,000 employees of the River Works of the General Electric Company at Lynn, Mass., will be forced to take their vacations according to the stagger system. Because of the great demand for certain products being manufactured at the plant, officials feel they cannot shut the plant down to allow their employees to have a two weeks vacation as they had last year. Vacations will be allowed, but the employees must take their holidays when their work allows.

At the West Lynn plant, however, the 250 employees will be allowed to take their vacations all at once because the plant will shut down for two weeks this month.

•

Commission Sanction Sought for Merger

Application has been filed with the Federal Power Commission by the Pacific Power & Light Company and the Inland Power & Light Company, both with principal offices at Portland, Ore., for authorization of the transfer of all the properties and assets of the Inland company, including its licenses for projects in Oregon and Washington to the Pacific company. Both companies are subsidiaries of the American Power & Light Company, an Electric Bond & Share affiliate.

The general character of the business done by the Inland company is stated to be that of owning and operating hydro-electric generating plants for the production and sale of electric energy at wholesale. The application alleges that, as Pacific company will assume and be obligated to perform and discharge all the liabilities and obligations of the Inland company, no interest, public or private, would be in any way prejudiced by the transfer. Hearing will be held July 19.

•

Diesel Contracts Approved

REA has approved three contracts between its borrowers and private firms for the installation of Diesel-powered electric generators and equipment, the first such contracts to be financed by REA. Two of the plants are to be installed in Iowa and the third in Virginia. All three are to be owned by REA-financed co-operatives. One Iowa project involves 2,750 hp., cost $191,968; the second Iowa project involves 2,750 hp., cost $184,730, and the Virginia project 750 hp., cost $71,095.

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Assessed at $13,551,000

Arkansas Corporation Commission has placed a tentative assessment on the Arkansas Power & Light Company at $13,551,000.

Niagara Hudson Home Plan to Be Expanded

Expansion of the Five Star Home program of the Niagara Hudson system, to result in the building of six homes instead of three, has been announced. According to the company this decision arose out of the answers to a questionnaire sent to 250,000 customers of the system, a majority of whom said they did not expect to pay more than $8,500 for their "ideal home."

Two types of homes are to be built in Albany, Syracuse and Buffalo. The first type has been designed without regard to the cost limitation indicated by the answers to the questionnaire. Those of the second type are also to have the Five Star features—modern wiring, lighting, kitchens, automatic hot water service and automatic heat with humidity control—but are to be smaller, of a different architectural type and are to be located on a different type of lot. Allowing for increased prices of building materials, they are being built for about the price indicated by the majority of replies, it is reported.

•

New England Power Group Moves to New Building

All executive and headquarters staff offices of the New England Power Association have completed transfer to a new eleven-story building at 441 Stuart Street, Boston, Mass. The new home of the association is a steel, brick and granite structure costing about $2,000,000 and having an exterior finish of Indiana limestone and face brick.

The equipment includes five Westinghouse electric elevators, acoustically treated ceilings, steam and electric service supplied by the Boston Edison Company and flexible wiring outlets furnished by the Walker "Allsteel Preset" underfloor distribution system. Pearson Associates, Inc., were the contractors and Blackall, Clapp, Whittemore & Clark the architects.

•

Rockwell City Plant Bids

Bids for the construction of the new $175,000 municipal electric light plant at Rockwell City, Iowa, are to be received by City Council on July 29. The project will include a power house, cooling tower, three engines and a complete distribution system.

Commission Rejects Smith Mountain Plea

Federal Power Commission has dismissed an application filed December 31, 1935, by the Smith Mountain Power Company, Alexandria, Va., for a license for a proposed major power project comprising a dam, reservoir, intake works and power house with a total proposed installed capacity of 30,000 hp. to be located on the Roanoke River in the counties of Bedford, Franklin and Pittsylvania, Va.

The commission's order of dismissal states that the applicant failed to furnish the commission within a reasonable period of time all of the information necessary for the consideration of the application. The order further states that the applicant resquested in March, 1936, that the application be held in abeyance pending the outcome of negotiations with the State of Virginia for authority to proceed with the power development and that the commission has not been notified that such authority has been granted.

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Merchandising Bill Dies in Connecticut

With the recent prorogation of the Connecticut Legislature the anti-merchandising bill, which would have prohibited gas and electric appliance sales by utility companies, met its predicted end, dying in the judiciary committee without the formality of a report to the Upper House.

Strong opposition had been expressed during hearings and sentiment against the bill increased at each mention of the measure. It had been contended that the bill, if enacted, would militate against rate reductions because it would slow down the rapid advance of home service and consequent increase in energy consumption, which makes lower rates possible.

Committee members were opposed to the bill on the grounds that it would impair servicing, retard the introduction of new appliances, delay price reductions, lower the bars to inferior devices, imperil dealer markets and cause unemployment.

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Record Appliance Sales

Sales of electric ranges and electric water heaters in the territory served by the Northern States Power Company, Minneapolis, are breaking all records, according to figures recently issued by the company. For the first five months of 1937 electric ranges totaling 3,604 and 1,848 electric water heaters were connected in customers' homes. The company serves 600 communities in Minnesota, North and South Dakota, Wisconsin and a small section of Illinois.

•

Rule Nisi Hearing Opens in Georgia

Georgia Public Service Commission recently began hearings on a rule nisi requiring the Georgia Power Company to show cause why its electric commercial rates should not be reduced, but recessed the case until July 12 to allow the power company to prepare additional data. President P. S. Arkwright asked for the delay, pointing out that the utility has recently lost its chief counsel and auditor by death.

The answer of the company to the rule nisi, read by President Arkwright, complained that the commission had reduced the electric revenues of the company $140,000 per annum in 1933, $101,000 annually in 1934, $250,000 per annum later in 1934, and the company itself put in an inducement rate that made a further reduction of $750,000 per annum in its revenues.

The answer further claimed that new forms of taxes, such as unemployment and social security taxes, chain store tax, etc., will increase the company's tax bill at least $250,000 this year. It was also brought out that the number of employees had been increased from 3,564 in 1933 to 5,163 in March of this year and that wages had also been increased, costing the company an additional $500,000 for this year. Cost of materials also rose sharply, the answer stated.

•

Permit for $100,000 Unit

As the first step in a $1,283,000 modernization program, the Milwaukee Electric Railway & Light Company has obtained a city permit for the construction of a $100,000 boiler house addition to its Edison Street power plant. A special high-pressure boiler will be installed to generate steam for commercial heating service. Installation of a steam turbine to increase production of electricity is contemplated for later in the year.

Effect of Grounding Reported by Group

Water purveyors within 100 miles of New York reported no cases of water or piping trouble when asked to cite instances to the American Research Committee on Grounding. Sixteen instances out of 22 known to the committee have, however, been investigated. The circumstances are classified thus: Sediment in water, 2; blue or green stain, 7; rusty water, 2; failure of boiler tubes, 2; service or house pipe corrosion, 2; electric spark, 1; taste and odor, 1; miscellaneous, 3.

In the majority of cases the cause could not be charged to any single factor. Removal of the alternating current, where found, has not substantially altered the manifestation causing the complaint, the technical subcommittee reported at a recent meeting. In these instances it was deduced that high temperature of water heaters, galvanic couples due to dissimilar metals in use in plumbing work, and differential aeration may have been to blame.

The committee will continue the field investigations while determining whether laboratory studies can be effective in answering the surmise that fugitive grounding currents are detrimental to water or underground metallic systems.

•

Commission Rejects Three Hydro Pleas

Applications, long pending, for three proposed hydro-electric projects in Tennessee and adjacent territory in North Carolina and Virginia have been dismissed by the Federal Power Commission.

Tennessee Eastern Electric Company had filed application July 31, 1926, for a preliminary permit for a proposed hydro-electric project consisting of three dams and appurtenant works on the Nolichucky River in Greene, Unicoi and Washington counties, Tennessee.

Holston River Power Company had filed on August 17, 1932, application for a license for a major project embracing four dams and appurtenant works on the South Fork of Holston River in Sullivan and Washington counties, Tennessee, and in Washington County, Virginia. This application was filed pursuant to preliminary permit granted by the commission on August 22, 1929.

Federal Power Company of Tennessee, now the Nolichucky Power Company, filed application May 15, 1926, for a preliminary permit for a proposed hydro-electric project consisting of diversion dams and appurtenant facilities on the Nolichucky-Toe River in Unicoi, Washington and Greene counties, Tennessee, and Mitchell and Yancy counties, North Carolina.

Smith Quits as Head of Brooklyn Edison

The resignation of Frank Whitney Smith as president of Brooklyn Edison Company this week marks the relinquishment of the last active managerial and administrative duties of this outstanding utility leader with the Consolidated Edison Company of New York, Inc., system. Mr. Smith will continue as a member of the board of Consolidated Edison and a director of its affiliated companies.

Having reached the retirement age of 70 years on June 22, Mr. Smith passes on to younger men management of the system which he has served for many years. Last March 17, at his own request, he was not re-elected president of Consolidated Edison, being succeeded by R. H. Tapscott. Mr. Tapscott is expected to become head of Brooklyn Edison.

Mr. Smith has been identified with the utility industry for 57 years, having obtained a job as office boy in January, 1880, with the United States Illuminating Company, only a few months before Thomas A. Edison perfected the incandescent lamp and more than two years before the famous Pearl Street generating station was opened. Mr. Smith succeeded George B. Cortelyou as president of Consolidated Edison in 1935. Later he was elected president of New York and Queens Electric Light & Power and Brooklyn Edison.

Long identified with the progress of the utility industry, Mr. Smith has been active in its growth. He was president of the National Electric Light Association in 1922 and served on many of its committees. He is now a trustee of the Edison Electric Institute, which succeeded the N.E.L.A., a member of its membership committee and chairman of its prize awards committee.

A descendant of Sir Francis Drake, Mr. Smith was born in Alden, Erie County, N. Y., June 22, 1867.

•

New Lines for Canadian Hydro to Provide New Power Source

Construction of transmission lines and a tie-up connecting the Quinte and Trent Valley Power companies' plants at Frankford and Campbellford with the Eastern Ontario system has been authorized by the Ontario Hydro-Electric Power Commission.

Installation of one small new unit is involved in the program, to cost approximately $470,000. When completed, the construction will provide an additional 4,300 hp. to the Trent Valley portion of the system, it is reported.

•

Steel Strike Repercussion

Strikes in the Middle West were blamed by a representative of Revere Copper & Brass, Inc., for a lay-off order, which cost about 200 employees of Rome, N. Y., plants of the company their jobs over the week-end. Many orders on file have been canceled or held up, the plant official said, due to the uncertain situation in the steel industry.

Acme

BONNEVILLE DAM—Waters of the Columbia River surging through the piers of the gigantic government hydro-electric power project 43 miles above Portland, Ore.

New York Municipals Cut Electric Rates

Following the demand of the New York Public Service Commission that municipally owned electric power plants reduce their rates, three municipal plants filed reduced schedules with the commission.

The village of Herkimer filed a new electric rate schedule, the principal change of which is a reduction in the minimum power rate charge from $250 to $50 a month.

The village of Greene has filed a new schedule which will mean reductions to all consumers of the village plant. The new schedule contains a residential and an all-purpose rate to replace four present rates of the superseded schedule. Customers will save $6,700 a year and of this amount residential users will save $3,733, commercial users $1,267, industrial customers $428 and others $1,272 annually.

Revised electric rates have also been filed by the village of Endicott. The rate is higher for small consumption, but is lower for large consumption than the rate filed in a previous schedule.

The New York Public Service Commission last week advised three more municipally owned electric plants to reduce immediately their residential and commercial rates, bringing the number of villages so informed to twenty-seven. Latest communities to be notified are Andover, in Allegany County; Castile, Wyoming County, and Theresa, Jefferson County.

•

Utility Authorized to Get REA Loan

Missouri General Utilities Company has been authorized by the state Public Service Commission to obtain a $112,000 loan from the REA to extend its electric lines in rural areas in Cape Girardeau, Bollinger, Stoddard, Perry and St. Genevieve counties. The commission ordered that the loan should be repaid in installments over a period of twenty years at an annual rate of interest of 2.77 per cent.

The commission's report stated that the proposed construction will provide electric service to 613 new customers. Its annual operating expenses would be increased about $20,000 annually, and its revenue $29,050, the company stated.

Chelan Power Line Defended at Hearing

Testimony overwhelmingly in favor of granting a permit for the Washington Water Power Company to build a transmission line along and across Lake Chelan to serve the Howe Sound copper mine was given by 125 residents of Chelan and other communities at the open hearing held recently by the U. S. Forest Service at Chelan.

W. J. Quigley, president of the Howe Sound Mining Company, said that other plans for power for mine development and operation, such as a Diesel plant, or a small hydro-electric development, were not feasible or were prohibitive in cost and urged the granting of the permit for the Washington Water Power Company to build a 50-mile, 110-kv. line from its Chelan power station to the mine.

Letters opposing the plan, all from non-residents, were read at the hearing by C. M. Granger, Washington, D. C., forest service representative.

•

Victoria Association Meets

The annual general meeting of the Victoria Electrical Association was held recently at Victoria, B. C. The following officers were elected: S. J. Halls, B. C. Electric Railway Company, honorary president; R. T. Murphy, Murphy Electric Company, president. A. Whiteman was named vice-president and A. R. Colby secretary-treasurer.

•

Rural Group Organized

A rural electrification association, similar to one formed recently at Henderson, which will link five western Kentucky counties, has been formed at Paducah. Counties in the association are McCracken, Marshall, Graves, Ballard and Livingston.

•

General Electric to Offer Air Conditioning Training

An extensive educational program, designed to attract young men into the air conditioning industry, has been launched by the General Electric Company, according to J. J. Donovan, manager of the air conditioning department. The plan is modeled along the lines of the "test" courses inaugurated by the company in 1888, and, while sponsored by the company itself, will be worked out through its distributors in the field.

The training program will be open primarily to graduates of colleges, technical schools and high schools, but in special cases it may be open to men who have been otherwise employed. Applications for training are to be made to distributors or to the headquarters of the air conditioning division in Bloomfield, N. J.

•

Purcell Elected President of National Heating Group

T. E. Purcell, Allegheny County Steam Heating Company, was elected president of the National District Heating Association at the recent annual convention in Detroit.

Other newly-elected officers include: J. R. McCausland, Philadelphia Electric Company; G. D. Winans, Detroit Edison Company, and Edward Lenz, New York Steam Corporation, vice-presidents. The new executive committee consists of M. D. Engle, Boston Edison Company; F. L. Witsell, Toledo Edison Company; and J. M. Arthur, Kansas City Power & Light Company.

Meetings

International Association of Electrical Inspectors — Joint annual meeting, northwestern and southwestern sections, Hotel Utah, Salt Lake City, August 23-26, F. D. Weber, secretary-treasurer, northwestern section, P.O. Box 70, Portland, Ore. H. L. Gerber, secretary-treasurer, southwestern section, 914 Merchants Exchange Building, San Francisco, Cal. Eastern section, Hartford, Conn., September 27-30, Joseph P. Rohan, general chairman, Hartford Building Department, Hartford, Conn.

American Institute of Electrical Engineers—Pacific Coast convention, Spokane, Wash., August 30-September 3. H. H. Henline, national secretary, 33 West 39th St., New York, N. Y.

Illuminating Engineering Society—Annual convention, Greenbrier Hotel, White Sulphur Springs, W. Va., September 27-30. A. D. Cameron, general secretary, 51 Madison Avenue, New York, N. Y.

Iron and Steel Exposition—Sponsored by the Association of Iron and Steel Engineers. Stevens Hotel, Chicago, Ill., September 28-October 1. Brent Wiley, managing director, Empire Building, Pittsburgh, Pa.

Indiana Electric Association — Annual meeting. French Lick Springs, Ind., September 30-October 2.

Maryland REA Unit Agrees on Territory

An agreement for the division of territory has been reached between the Maryland Light & Power Company and the Southern Maryland Tri-County Co-operative Association, Inc., which has been granted a $165,000 loan by the Rural Electrification Administration.

The agreement was reached during hearings before the Maryland Public Utilities Commission at which the co-operative requested permission to construct 162 miles of line and the cancellation of a permit previously granted to the company for a 6-mile extension of its system into territory included in the co-operative plan.

It is also provided in the agreement that the company abandon all but one mile of its proposed extension and that the co-operative will omit from its network the towns of Loveville and Morganza.

•

Slave Falls Contracts Let

Tenders for another generator and turbine for the Winnipeg Hydro-Electric Company's Slave Falls plant were awarded by the civic public utilities committee recently at Winnipeg. The Dominion Engineering Company's price of $97,500 for a turbine and the Swedish General Electric Company's tender of $141,655 for a generator without parts were accepted.

•

REA to Allot $150,000

John M. Carmody, Rural Electrification Administrator, has stated that the REA is prepared to allot $150,000 to the Northern Neck Rural Electric Association in Virginia on receipt of a map showing proposed lines to be built.

•

Scott Confirmed by Senate

The Senate has confirmed the nomination of John W. Scott to be a member of the Federal Power Commission. He succeeds Herbert J. Drane.

•

Photo Correction

The credit line of the illustration on page 10 of the June 26 issue of ELECTRICAL WORLD should have read *Minneapolis Journal* instead of *Milwaukee Journal*.

Output Continues Moderate Gains

Energy production by the electric light and power industry continues to increase at a moderate pace, but the upward trend is flatter than it was a year ago. Output during the week ended June 26 was 2,238,332,000 kw.-hr., according to the Edison Electric Institute, indicating a small gain over the two preceding weeks. The advance over the like week a year ago was 11.6 per cent, virtually the same as in the week before, but smaller than in the spring months.

Labor disturbances are apparently reflected in national and regional percentages. In the Central industrial area the average gain over 1936 was 12 per cent in June, against 15 in May and 22 in March. Indirectly affected, the Mountain states dropped sharply. Changes elsewhere were smaller.

Weekly Output, Millions of Kw.-Hr.

1937	1936	1935
June 26...2,238	June 20..2,005	June 22..1,775
June 19...2,214	June 13..1,990	June 15..1,743
June 12...2,214	June 6..1,945	June 8..1,724
June 5...2,131	May 30..1,922	June 1..1,629
May 29...2,207	May 23..1,955	May 25..1,696
May 22...2,199	May 16..1,962	May 18..1,700

Per Cent Change from Previous Year

Region	Week Ending June 26	June 19	June 12
New England.....	+10.4	+10.3	+ 9.2
Middle Atlantic.....	+11.3	+11.5	+13.4
Central Industrial...	+12.7	+12.2	+12.9
West Central.....	+ 7.1	+ 3.1	+ 4.4
Southern States.....	+13.1	+13.1	+13.8
Rocky Mountain....	+10.0	+13.4	+27.9
Pacific.....	+ 5.9	+ 6.8	+ 9.1
United States.....	+11.6	+11.3	+13.8

Ohio Edison Seeks to Issue $10,000,000 Mortgage Bonds

Ohio Edison Company has petitioned the Utilities Commission for permission to sell $10,000,000 first mortgage bonds with maximum maturity 25 years and interest rate not to exceed 4 per cent. Cost to the company would not exceed 4 per cent of total.

The proposed issue would capitalize uncapitalized additions to the plant as of April 30, 1937, and other improvements contemplated during the current year totaling $14,507,141.

•

Illustrates Use of Power

Iowa City Light & Power Company recently carried a full-page advertisement in the new building edition of Iowa City *Press-Citizen* to carry an industrial message as to the use of electricity in industrial plants. Pictures were employed to illustrate the many uses of electric power. The company signed itself "A Good Tax-Paying Citizen."

•

Lighting System Extension

City Council, Philadelphia, Pa., is considering a program for the substitution of electric street lights for 15,000 of the present 23,000 gas lights now installed on different thoroughfares. The change is estimated to cost $55,954, including installation of improved-type street-lighting units, wiring and connections. It is said that the substitution will show a net saving to the city of approximately $357,000 a year, according to engineering estimates.

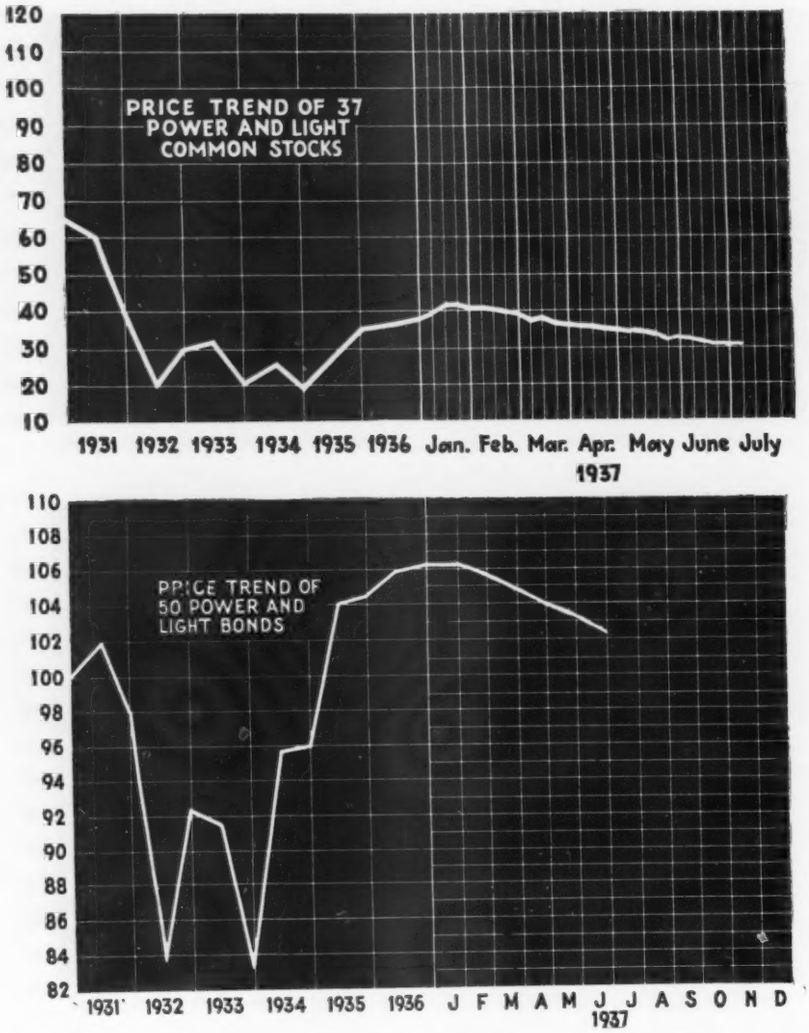
•

Electric Sales in Illinois

Total sales of electricity to ultimate consumers in Illinois reported for the month of May amounted to 570,972,729 kw.-hr., an increase of 14.1 per cent over the similar month last year. A slight decrease of 2.1 per cent is noted in the May sales this year, when compared with those of April.

These figures exclude intercompany transfers for the purpose of resale and represent the actual amount of electricity used by final consumers. Previous to the month of May these figures covered twelve large companies; however, due to a recent merger the number has been reduced to eleven.

Utility Stocks Steady; Bonds Slightly Lower



Utility stocks remained relatively unchanged during the past week. "Electrical World" index, 30.6; previous week, 30.8; year ago, 36.5; 1937 high, 41.5. Bonds were slightly lower during June, the index dropping from 103.4 to 102.5. Bond index a year ago, 105.9; 1937 high, 106.2.

Securities Purchase Gets SEC Approval

SEC has approved an application by the States Electric & Gas Corporation, which was organized recently under the laws of Delaware with a nominal capital and which has registered as a company purporting to become a holding company, for permission to acquire from the General Water, Gas & Electric Company and the American Equities Company certain securities, including those of public utility and other companies.

Securities and claims involved are valued at approximately $2,000,000. Payment for them is to be $25,000 in cash and the remainder in securities of the applicant company.

Regardless of the small cash payment involved, the commission found that the transactions might be regarded as a reorganization in compliance with the policy of Section 11 of the Public Utility Holding Company Act. The commission, however, placed restrictions upon payment of dividends by the subsidiaries to be acquired.

•

New England Power Group Cuts Bank Loans $500,000

Bank loans of the New England Power Association, incurred to retire previous indebtedness bearing higher rates of interest, have been reduced by $500,000 since the end of last year and now amount to $1.750 000, according to a recent announcement by Frank D. Comerford, chairman. Consolidated bank loans of the Association and its subsidiaries now aggregate only $2,250,000 compared with over $4,000,000 at the close of 1935.

•

N. Y. State Electric Plans $8,500,000 Preferred Issue

New York State Electric & Gas Corporation, subsidiary of Associated Gas & Electric Company, has been authorized by the Public Service Commission to issue $8,507,800 of its 5 per cent cumulative preferred stock of $100 par value, to be sold at not less than par and accrued interest.

Proceeds are to be used for these purposes, according to the report: $5,000,000 toward construction of projects estimated to cost $7,292,031, $1,650,000 to pay outstanding notes payable to the constituent Elmira Light, Heat & Power Company, $1,837,800 to pay purchase of 18,378 shares of preferred stock of constituent companies held by the public and $20,000 to discharge a money purchase mortgage on the Binghamton office building.

•

Property Transfer Approved

Ohio Utilities Commission has approved transfer of the bankrupt Alliance Power Company's property to the newly organized Alliance Public Service Company.

•

Gets New Rural Franchise

Iowa Southern Utilities Company has been granted a franchise for the erection of 18½ miles of rural transmission lines in Jasper County.

Earning Reports (Utilities)

	Net Income 1937	1936
Nat. Pwr. & Lt. and subs.	$7,849,047	$6,481,346*
Amer. Pwr. & Lt. and subs.	10,989,297	9,007,274*
Elec. Pwr. & Lt. and subs	9,248,975	4,568,636*
United Gas Corp. and subs.	11,606,408	7,969,349*
Assoc. Gas & Elec. and subs.	36,029,216	34,479,409*§
Standard G. & E. and subs.	4,659,521	2,744,444†
N. Y. State Elec. & Gas Corp.	1,446,510	1,370,779‖
NY PA NJ Utilities and subs.	20,199,145	17,620,651‖§
Louisville G. & E. (Del.) and subs.	1,550,681	1,594,784†
North. States Pwr. (Minn.) and subs.	5,398,649	4,663,215†
Florida Power & Light	1,612,707	915,610*
Texas Power & Light.	2,006,763	2,019,854*

‖ Twelve months ended March 31.
† Twelve months ended April 30.
* Twelve months ended May 31.
§ Operating income.

Distribution Capacitors

An Inexpensive Method of Adding Feeder and System Capacity Quickly

HOW distribution feeder capacity was increased 25 per cent by G-E Pyranol capacitors for a Midwestern operating company; how a saving of $28,000 in capital investment over customary methods of gaining capacity was realized; how voltage levels at new load were even better than before.

DURING the last year, the engineers of a number of progressive Midwestern operating companies applied G-E Pyranol distribution capacitors to their distribution circuits. Careful, accurate observations of these installations have been made to check their worth, and to provide a basis for future system development. The results obtained on one of these feeders, after the installation of two capacitor equipments, is typical, and warrants careful consideration of this quick and inexpensive method of increasing system capacity by improving the power-factor.

Needed More Capacity

The feeder in question is of overhead construction, but is supplied by one mile of cable from a substation supplying a metropolitan area. A substantial increase in capacity was needed to meet expected load conditions for the winter of 1935-36. After analyzing the relative costs of providing additional feed to separate this feeder into two sections, compared with that of providing the increased load-carrying ability by the installation of distribution capacitors, the latter was determined on, and two 180-kva capacitors were installed.

Capacity Increased 25 Per Cent

Previously the feeder carried 265 amperes per phase, but during the winter season which followed the installation of the capacitors, it carried about 315 amperes per phase—equivalent to 331 amperes at the original unimproved power-factor of the feeder.

Better Voltage Regulation

Voltage regulation was improved as well. It was found that without the capacitors there was a voltage differential of 7.8 volts, while with them, this difference was reduced to 4.6 volts. A drop of six volts is considered acceptable.

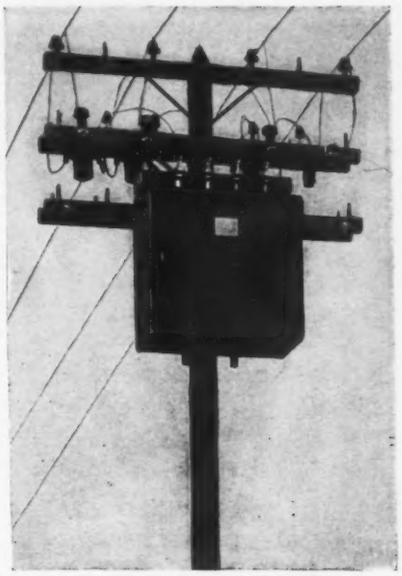
Saved—$28,800

Had the capacitors not been installed, and had another feeder been added, an investment of $32,300 would have been required to supply 1500 kw of additional capacity—a cost of $21.50 per kw. Actually, only 500 kw was needed, and the capacitors supplied it for $3,500—a cost of $7.00 per kw. Note that the cost of $3,500 incurred is approximately one year's carrying charge on the large investment which would have otherwise been necessary. Thus these capacitors can be considered as paying for themselves each year that they defer the major expenditure.

G-E Pyranol Capacitors Chosen

G-E Pyranol capacitors were selected because of their following outstanding advantages.

1. **Low operating cost**
2. **Low installation cost**
3. **Special provisions for ventilation are unnecessary**



Typical installation of G-E pole-type capacitor rated 180 kva, 3 phase, 60 cycles, 4000 volts

4. **Special foundations are not required**
5. **Flexibility**
6. **Can be obtained quickly**
7. **99.83 per cent of the Pyranol capacitor units—manufactured in the last six years—have a perfect operating record**

It will pay you to investigate this method of adding kw capacity to your system. The coupon will bring you further information. General Electric, Schenectady, N.Y.

SEND IN THIS COUPON

General Electric, Dept. 6-201
Schenectady, N. Y.

Send me one copy of each of the bulletins checked.

- ☐ Application of distribution capacitors GEA-2509
- ☐ Class DPT capacitors GEA-2494
- ☐ Class ID capacitors GEA-2561

Name.....

Company.....

Address.....

City..... State.....

360-119

GENERAL ELECTRIC

Field OPERATING PRACTICES

New ideas and practices in the operation of well-designed, constructed and maintained plants and systems

Reclosing Scheme for Small Stations

By H. R. MOORE
Idaho Power Company, Boise

To make it economically possible to adapt automatic reclosing to breakers on small isolated substations the engineers of the Idaho Power Company have developed an inexpensive mechanism which can be constructed at a cost of less than $100, including material and overhead. Installation cost of the thirty that are now installed in the system averages $35.

The mechanism, as developed, can be used on both General Electric and Westinghouse switchboard type breakers up to and including 15,000 volts, 300 amp. rating. The original hand-operating mechanism, trip coils and relays are not supplanted. It can be used on outdoor type of switches up to 15,000 volt, 100 amp. rating by the addition of a weatherproof sheet-iron cover and outside crank mechanism.

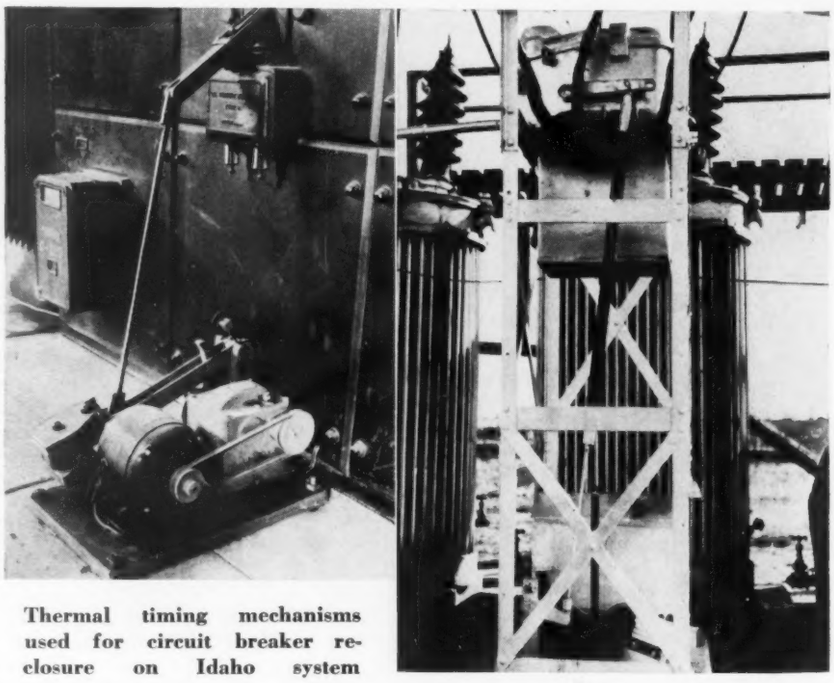
The principle of operation of the reclosing mechanism and timer is as follows:

The oil circuit breaker is equipped with an auxiliary switch which is wired in series with a thermal switch and motor. The tripping of the oil circuit breaker closes this circuit to the motor, which starts and raises the counterweighted lever arm. The first motion of the weight arm unlatches the latch and the next motion moves the operating mechanism to the reset position. As the cam turns, the weights are allowed to drop, thus closing the switch. When the switch closes the auxiliary switch opens the motor circuit.

If the oil circuit breaker does not stay closed the above operations are repeated. During these operations the thermal switch is heating, and after the third reclosure the thermal switch opens the motor circuit. Thus, the number of reclosures is determined by the size of the heater and the thermal switch. At present the practice is to provide a heater in the thermal switch which will give three reclosures. It is apparent that if the circuit breaker does not trip immediately after reclosing the thermal element cools and the mechanism is ready to reclose three times more.

Features of the mechanism are (1) the oil pressure breaker is held closed by its own latch, not held by the weight; (2) periods between successive reclosures are not adjustable, but the time before the lock-out may be adjusted by choice of gear ratio, pulley sizes and the heater in the thermal switch used as a timer; (3) by using a gear ratio of 620 to 1 with a 1,725-r.p.m. motor and a one-to-one pulley delay after tripout is approximately 22 seconds; (4) on switches whose interrupting capacity is not equal to this service the time was lengthened to 30 seconds by a different pulley ratio.

Originally 1/6-hp., split-phase motors were used, but the combination of inherent high starting current, plus the effect of cold weather on motor bearings and gears, caused the thermal cutout in the motor circuit to be erratic. The motors, therefore, were changed to the repulsion-induction type and the transmissions filled with refrigerator oil. With these changes the mechanism has given practically no trouble and has operated very satisfactorily.



Thermal timing mechanisms used for circuit breaker reclosure on Idaho system

The motor-gear transmission mechanism drives the cam-controlled counter weight which closes the breaker by gravity force. A thermal switch in the motor circuit limits the timing and number of reclosures. Outdoor installation of the reclosing mechanism is connected to the circuit breaker operating lever by means of a toggle and arm. The indoor mechanism is adapted to outdoor use by means of a sheet-iron inclosure shown herewith

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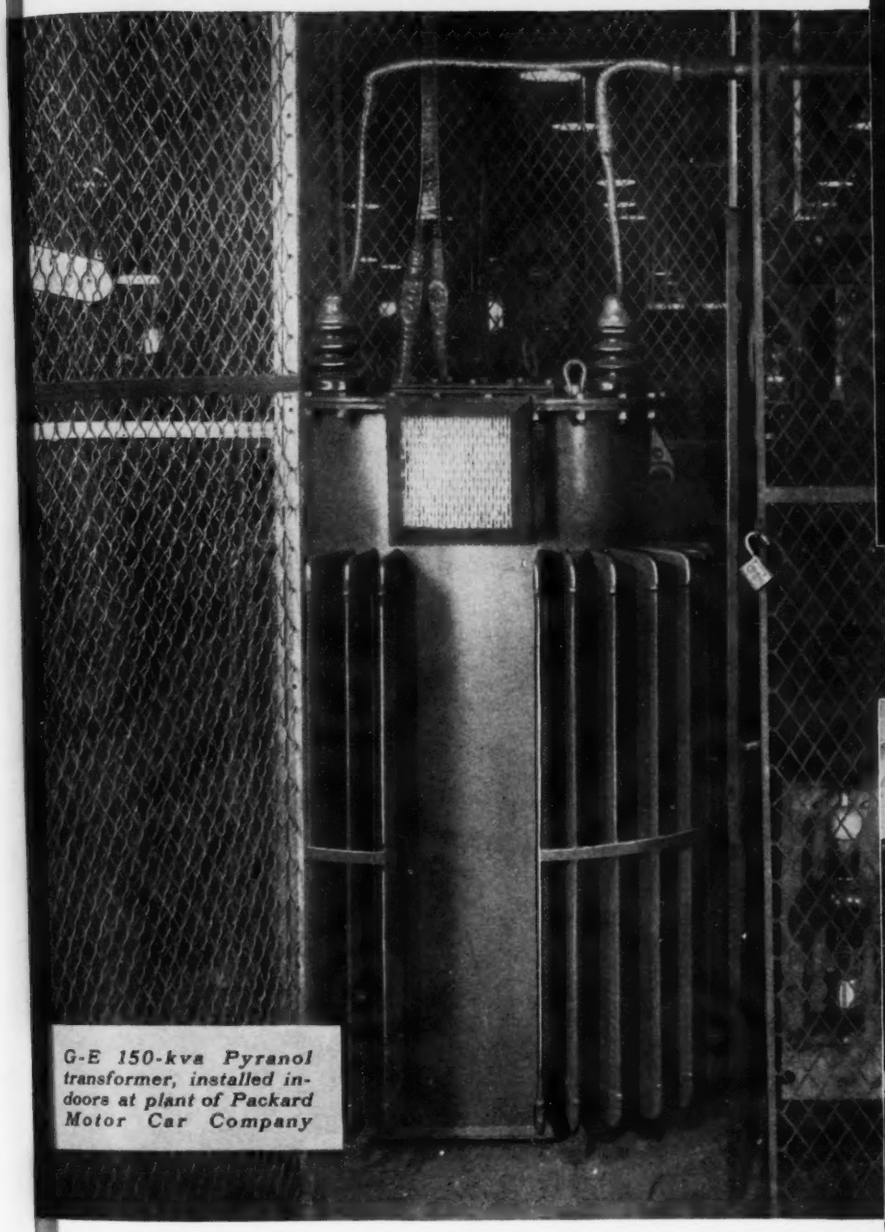
New British Oil Breaker Specification

The new oil circuit breaker specifications recently adopted as standard in Great Britain provide for:

HOW PYRANOL TRANSFORMERS CUT INSTALLATION COST AT PACKARD MOTOR CAR CO.



G-E 150-kva Pyranol transformer, installed indoors at plant of Packard Motor Car Company

PACKARD Motor Car Company recently installed a Pyranol transformer, and because a user's viewpoint on this noninflammable, nonexplosive equipment may point out ways in which you, too, may save, we "asked the man who owns one"—about Pyranol. ● "Why," we asked, "did you select a Pyranol transformer?" ● "This is an unusual installation," they told us. "The transformer steps up a 440-volt circuit to 6600 volts across the tubes of a Thyratron welding control panel. A Pyranol transformer gave us the installed economies we want. Had we used oil, the transformers would have had to go in a vault or on the roof. A vault costs money, and besides it would complicate the operation and maintenance of the welder. From the roof, the high-voltage run to the control panel would be 40 or 50 feet, all in concrete. Pyranol saved us money either way you figure it." ● "How much space does the installation take?" ● "Seven by nine feet, and all high voltage is within the grillwork."

Pyranol transformers have been recognized by the National Electrical Code, which permits their installation indoors with many of the restrictions applying to oil-filled transformers removed. More than 1000 units, totaling over 300,000 kva are installed, some units for more than five years, and all giving excellent service. Let us tell you more about these noninflammable, nonexplosive transformers, or write for Bulletin GEA-2048. General Electric Co., Schenectady, New York.

300-63

GENERAL ELECTRIC

1. Limitation of ampere short-circuit rating.
2. Tests at other than the full rated rupturing capacity.
3. Recovery voltage.
4. Restriction of the value of the d.c. component for determining the rupturing capacity of average speed breakers, with provision for its inclusion for high-speed breakers.
5. Control of test plant decrement.

These new standards limit the maximum rupturing capacities in the various voltage classifications as follows:

6.6 kv.	500 mva.	22 kv.	1,500 mva.
11 kv.	750 mva.	66 kv.	2,500 mva.

•

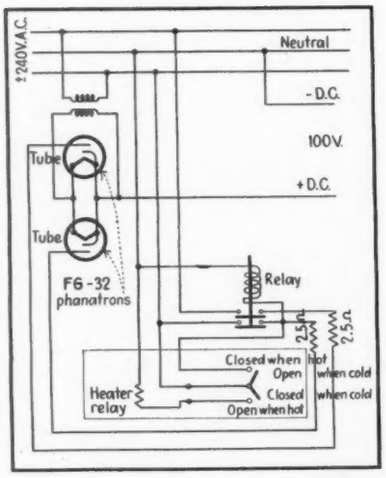
Rectifier Utilizes Novel Thermal Relay

By C. R. MACHEN

Pacific Gas & Electric Company, Oakland, Calif.

Extreme simplicity in design and operation is a feature of a rectifier installed in the offices of the Pacific Gas & Electric Company, Oakland, Calif., to provide current to operate the map roller in the load dispatcher's office. The latter device, powered by a ¼-hp. standard, d.c. motor with a foot-operated rheostat, rolls or unrolls the system map, beneath a glass window. When it is considered that the system is some seven or eight hundred miles long it will be appreciated that speed-control is important even if the map is on a small scale.

Selected because of its quietness and lack of maintenance, the rectifier consists of two FG-32 phanatrons connected to form a full-wave rectifier. Filament current is taken from a small transformer connected across the outside legs of a 240/120-volt, three-wire circuit. The plate current is supplied directly from the 240-volt legs. Operating instructions, however, specify that the plate potential should not be connected until after the tubes have been heated up to a stable temperature, a process which generally takes from four to five minutes. To prevent this, an unusual relay was designed by the Greatwestern Electro-Mechanical Company of Oakland, Calif. This relay, operating on a thermal principle, is designed to duplicate the heat absorption and radiation characteristics of tubes through the use of fins placed upon a long, metallic tube. The movable element of the relay is a rod, the expansion of which of only a few thousandths of an inch will operate a switch. This switch in turn operates



Self-protecting heater relay prevents premature application of plate current to rectifier

the relay which places plate potential on the tubes. As the heat characteristics of the relay have been made equal to the FG-32 phanatron by "cut-and-dry" methods, the plate current cannot be applied to the tubes except after the tubes and relay have heated up to a safe value. Should power go off momentarily the relay would drop the plate current off, but would pick it up again within a few moments after the circuit was energized. This characteristic avoids the long delay that would occur should a mechanical time-delay device be used. In operation, there is approximately a 20-volt drop across the tubes, making the d.c. voltage approximately 100 volts, which has little or no effect upon the operation of the map roller.

•

Hartford Reviews Plant Problem

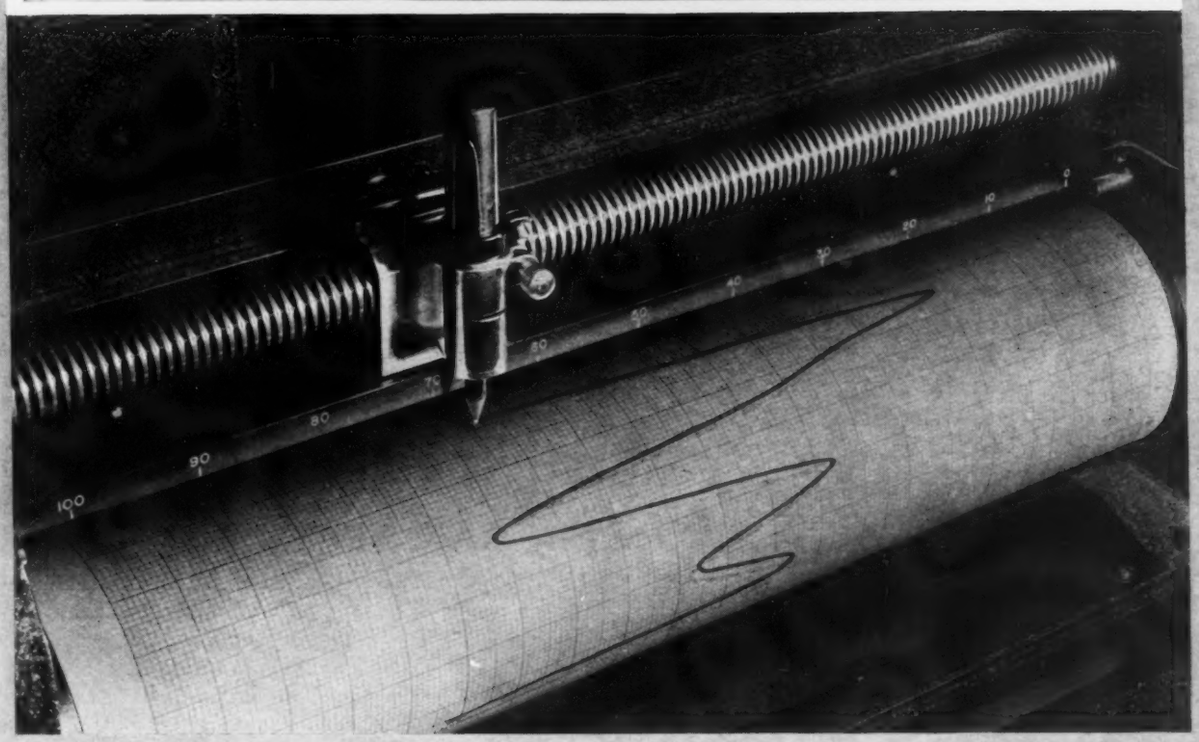
Hartford Electric Light Company's recent purchase of a 40,000-kw., 850-lb. steam turbo-generator for South Meadow station is of interest in relation to various alternatives which were considered in the decision, especially in view of the company's pioneer work in the successful application of the mercury boiler and turbine to utility practice. The hourly peaks of the company last November and December frequently exceeded 100,000-kw., and almost every month in the latter part of the year previous landmarks were passed and left behind. The plant contains one 40,000-kw. and two 20,000-kw. steam turbo units, with a 10,000-kw. unit driven by a mercury turbine. The older station at Dutch Point and an important interconnection with the Western Massachusetts Companies' system, with other tie-ins of moderate capacity between Hartford and the Connecticut Power Company, were also available and used as advantageous.

Analysis of the South Meadow situation indicated that it would pay to take advantage of the low rates prevailing on borrowed money, and that a new 40,000-kw. unit would save enough in operation to just about cover interest on the bonds since issued. The addition of a 40,000-kw. turbo unit and companion boiler (capacity about 400,000 lb. per hour) involves an expenditure of about $3,500,000, including building extension.

It was logical for the company to consider adding another mercury unit of double the present capacity (*e.g.*, a new outfit of 20,000 kw. in electrical energy and about 24,000 kw. in equivalent steam capacity for use in the present steam units). Vice-President T. H. Soren recently stated that the General Electric Company was not in a position to offer a unit of this size, so this solution was "out." A second plan considered was to remove two of the present smaller boilers at South Meadow and replace them with two units of double the capacity and higher pressure. This would be feasible because of the progress in steam boiler design in the past fifteen years. The plan also contemplated replacing one of the 20,000-kw. machines with a 40,000-kw. machine, later carrying out the same program with the remaining two boilers and a second 20,000-kw. unit.

A third proposal was to take out two of the existing small boilers and replace them with one 1,400-lb. boiler, adding to the station a 15,000-kw. superposed turbo-generator. The steam in the 1,400-lb. unit would exhaust to the 250-lb., 20,000-kw. machines now in service. Units of this size pass a large amount of steam for lower pressure unit use and make a highly economical combination, but study of the situation showed that at certain times such a combination could not be used efficiently. Certain operating problems arise from the company's utilization of surplus hydro-electric energy, chiefly obtained from the Connecticut Valley Power Exchange, and the load is reduced during some parts of the year to a degree militating against economical use of a superposed unit.

To Measure—COLOR ELECTRICALLY



MAUVE, orchid, vermilion, the infinite varieties of gray and white—all these yield their secrets to a measuring instrument invented by Prof. A. C. Hardy of M.I.T. and developed for commercial application by General Electric measurement engineers. Manufacturers of colored inks, of paper, of paints, and of textiles can trust the colors if the color values are checked by the recording photoelectric spectrophotometer—the instrument that analyzes color and writes an exact color *analysis*.

Color is but one of many fields to which General Electric engineers have brought the science of accurate measurement. General Electric instruments measure sound, light, vibration, even the power of lightning. For electric measurement, there are instruments to measure current, voltage, resistance, watts, frequency, power-factor—dozens of standard styles, indicating and recording, in ratings to fill every need.

For almost 50 years General Electric has been a leader in the design and manufacture of electric instruments. Its engineers bring to measurement the experience gained in every field of electrical endeavor. If you have a problem that involves the measurement of any quantity, remember that General Electric is HEADQUARTERS FOR ELECTRICAL MEASUREMENT. General Electric, Schenectady, N. Y.

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430-80

GENERAL ELECTRIC

The solution reached called for an entirely new boiler and steam turbo unit, which will utilize a temperature of 900 deg.F., thanks to metallurgical progress. This requires expensive alloy steels in the superheaters, piping and parts of the turbine. At 250 lb. the new turbine and boiler will constitute practically an independent unit in the station, but through reducing valve use and desuperheating a certain amount of steam can be used in the present 400-lb. machine. The new 40,000-kw. outfit and boiler will cost about the same as it would to carry out the second plan in two steps leading to the same ultimate capacity, and there are advantages in making the addition in a single step. It is expected that the improvement will be completed during 1938.

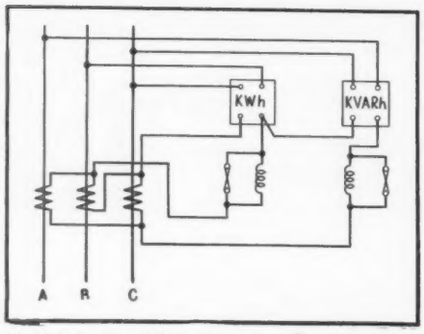
•

Metering Is Feasible With ZCT Connection

By G. W. STUBBINGS
Winchester, England

The Z-connection of the secondaries of three current transformers is used to obtain certain response to short-circuit and ground faults in a three-phase circuit by means of two over-current trips only. Since none but residual currents appear in the external secondary network, the method of connecting a single-phase meter for temporary energy or reactive measurements is not at all evident. The accompanying diagram is that of a set of Z-connected current transformers for operating two fuse-shunted over-current trips and it shows how a single-phase meter can be inserted into the network for the measurement of kilowatt-hours or reactive-kva.-hours. The energy meter carries the difference of two line currents and is energized by the voltage between these lines.

If the load is balanced the meter will register the total energy correctly and the constant will be the ratio of the current transformers. The reactive meter carries the resultant of the currents in two lines and is energized by the voltage between these lines. It will register reactive-kva.-hours in a balanced load with a constant of $\sqrt{3}$ multiplied by the transformer ratio. The rule for connecting the meters in the circuit is easily remembered; the energy meter is joined to the common connection of transformer terminals of unlike polarity, the reactive meter to



Current transformers in Z-connection adaptable to temporary metering

that of similarly marked terminals. In each case the voltage circuit of the meter is joined to the lines containing the corresponding current transformers.

If K is the ratio of the registration of the reactive meter to that of the energy meter the average power factor can be determined at once by the formula: Power factor $= \sqrt{\dfrac{1}{1 + 3K^2}}$

•

Inflation Test for Rubber Gloves

Blowing up a rubber glove with compressed air to see if there are any holes in it requires some means for holding the glove and the devising of such means has given many testers a chance to exercise their ingenuity. One of the neatest of these devices is the one used in the rubber test shop of the Northern States Power Company in Minneapolis. It consisted of a truncated cone turned out of hard wood and finished off smoothly. Through the center of the cone runs the air pipe which also serves to mount the cone in a vertical position.

The slope of the cone and its thickness are such that the wrist of a glove can be placed snugly over it with the wrist bead about half-way down on the cone. A smoothly finished fiber ring is placed over the glove and pressed down firmly on the wrist bead, holding the edge of the wrist snugly against the surface of the cone. The air is then turned on and the glove inflated. A two-way valve in the air line allows the air to discharge from the glove when the inspection is completed.

Conical holder speeds inflation test of rubber gloves

•

Sand-Creosote Collar Protects Wood Poles

To overcome the attendant cost of excavating standing poles for preservative treatment, the Hydro-Electric Power Commission of Ontario has developed a ground-line treating collar which can be economically installed on all types of poles, both new and old. This collar will give a setting said to be as strong as the surrounding earth, provide a method of retreating without excavation, maintain a sterile area of soil around the pole to the depth of the bandage and stop the surrounding earth from drawing creosote from the pole.

A collar formed from a sheet of heavy galvanized iron is wrapped loosely around the pole above the ground line and tied at the bottom with a light piece of wire. This is lowered into position to cover the 18-in. section of the pole immediately below the ground line. A cone-shaped container is formed by the sheet by inserting several temporary, tapered wedges which force the top edge away from the pole and draw the lower edges of the sheet metal tightly against the pole. The container is nailed to the pole through one of the wedges at the overlap and filled with fine dry sand.

By removing the temporary wedges and using them as tampers the sand is consolidated and brought to within 2½ in. of the top. Creosote is poured into a depth of 2 in., and after absorption the empty portion of the collar is filled with a saturated mixture of creosote and sand.

The principle underlying the development of this method of treatment was based on the experimental observation that an 18-in. column of dry sand will hold 20 to 25 per cent of its volume of creosote, depending on the fineness of the sand. Cedar in contact with this treatment will absorb 75 per cent of this creosote, leaving about 25 per cent in the filler, which is enough to inhibit fungus growth. Tests and observations to date indicate that under ordinary conditions this residual creosote will not leach out by water, according to the *Bulletin* of the Hydro-Electric Power Commission of Ontario.

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Industrial ELECTRIFICATION

New ideas and practices in industrial electrification as presented by industrial, consulting and power sales engineers

Capacity Effects Upset Control System

By WILLIAM A. TRIPP
Associate Engineer
U. S. Army Engineers Corps

Shortly after the Buzzards Bay lift bridge spanning the Cape Cod Canal in Massachusetts was placed in operation in December, 1935, it was noticed that certain relays and contactors in the a.c. system controlling span lifting and locking mechanisms frequently failed to open when disconnected from one side of the line by automatic controls. Train delays and danger to boats passing under the span resulted since, with failure of the relays, it became impossible to stop certain parts of the mechanism in any known position. Failure to release by contactors controlling railroad rail locks on occasion made it impossible to raise the span until the lock was opened by hand.

Study of the circuits causing trouble indicated the existence of faulty currents in the relays equal or close to their rated minimum holding current values. These currents were sufficient to cause the relays to "stick" when disconnected from one side of the line. Trouble was found to be restricted to circuits in a 1,000 ft. multiconductor control cable going up the north or control tower and across the canal to the base of the south tower; that is, circuits which had long leads still attached to control devices when these devices were disconnected from one side of the line.

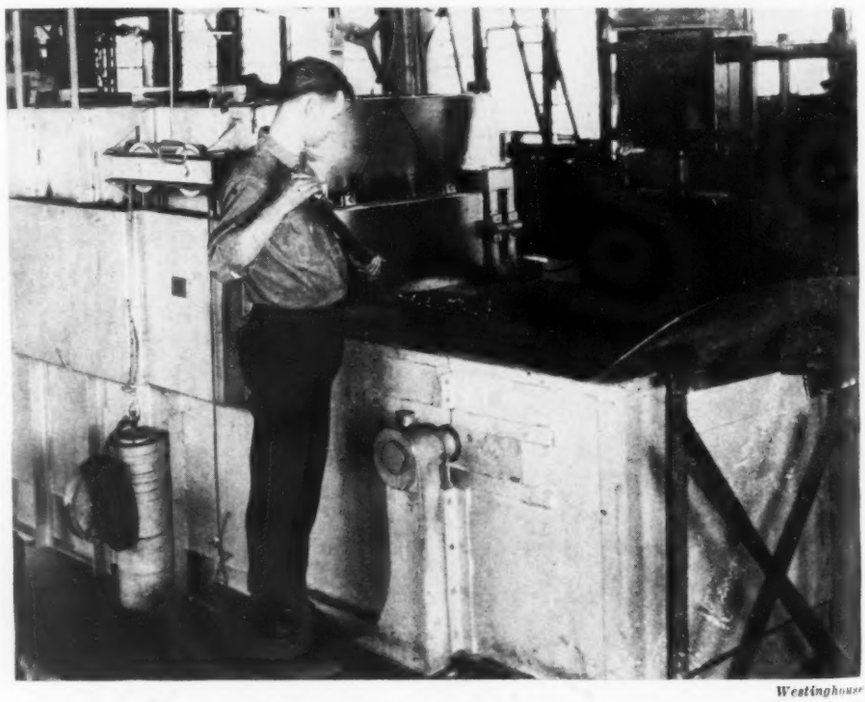
Capacity calculations supplemented by capacity bridge measurements on the troublesome circuits indicated that charging currents arose from capacitive coupling of long leads on the open side of the relays and contactors adjacent to energize wires. Thus, in effect, the de-energized circuit wire acted as a condenser plate in the midst of a number of other wires that were carrying potential.

The difficulty was overcome by shunting the devices so affected with suitable resistors to by-pass capacity current to such an extent that the current passing through the relays after the circuit was opened was positively less than enough to hold them closed. Addition of the resistors to the system admittedly involves the undesirable feature of adding devices which may themselves become a source of trouble and in addition it also permits the capacity condition to remain.

While the method adopted thus may not be the most satisfactory, it boasts the merits of directness and low cost in view of the fact that the control system was all installed.

Other alternate solutions were considered, such as use of a d.c. control system, disconnecting both sides of control relays instead of one side only, regrouping of circuit wires so adjacent wires would have the same potential. Cost considerations largely caused these to be rejected.

ELECTRIC HARDENING FURNACE QUENCHES PARTS AUTOMATICALLY



Westinghouse

Small parts are continuously hardened in this 120-kw. electric furnace at the Pittsburgh plant of the Oliver Iron & Steel Corporation. At the end of the hardening period the parts are automatically dumped into the quench at the discharge end of the furnace.

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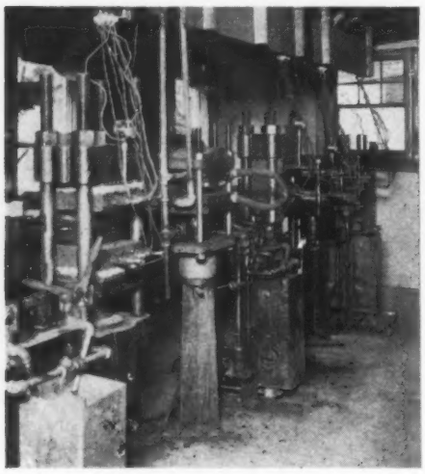
Electric Heat Boosts Press Production

Cartridge type heating units by providing accurate temperature regulation and electric heating services on a 24-hour basis have made it possible to hold production to a maximum through periods of diverse outputs at the Newton, Mass., plant of the W. M. Gulliksen Manufacturing Company. Nine 2,000-lb. hydraulic presses used in molding bakelite insulation are now equipped with 220-volt cartridge type heating units which have replaced steam coils for heating purposes.



Part of bakelite molding press installation served by electric heating units

Six 1,000-watt units, divided equally between upper and lower plates of the presses maintain a temperature of 350 deg. F. while molding powder is being pressed into required bakelite shapes under pressure. Officials of the company state that the use of electric heat insures clearer shop space compared with steam piping, excellent working conditions the year round, and does away with the chance of contact burns from high-pressure steam.

•

Welded Pen Points Build Mass Demand

Accurate timing of electric welds is a vital feature in the manufacture of fountain pens designed for mass sales at low prices by the American Platinum Works, Newark, N. J. This company recently succeeded in manufacturing synthetic iridium grains for fountain pen use. These grains are so uniform in size that no grinding of pen points after splitting is required where a practical method of joining the iridium grain to the stainless steel pen nib is available. The Platinum company developed an automatic electric welder for this purpose, shown herewith, in connection with timing control provided by Welding Timer Manufacturing, Inc., of Newark.

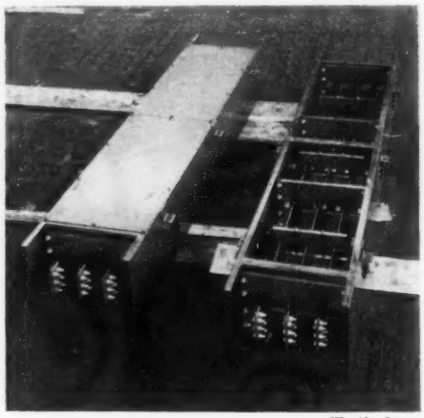
The iridium grains are contained in a hopper at the rear of the welder frame. An automatic feeder picks out one grain and feeds it through a channel to the lower block on the welder, where it is properly positioned by two fingers. The welding ram then descends and triggers off the timer. Current flows for a period equivalent to about one cycle. This completes the weld and the machine returns to its original position. The operator only feeds a pen and depresses a lever on the right side of the welder, all other operations being automatic. Pens can be made in this manner at the rate of 30 per minute, it is said. Direct current gives results far superior to alternating current in this work, so the power supply is furnished by a 300-amp., 6-volt motor-generator set. The welding current is regulated by the usual motor-generator field rheostat and by an adjustable resistance in the form of a nichrome bar on the front of the bench that is used to support the timer control mechanism.

The commercial importance of this process depends on making available an iridium tipped pen with a durability comparable to high-grade fountain pens at a price sufficiently low to permit their sale by low-price chain store groups. Some of these pens have appeared on the market at 50 cents retail, or less, a price which permits a large volume of business.

•

Unit Bus Assemblies Simplify Installation

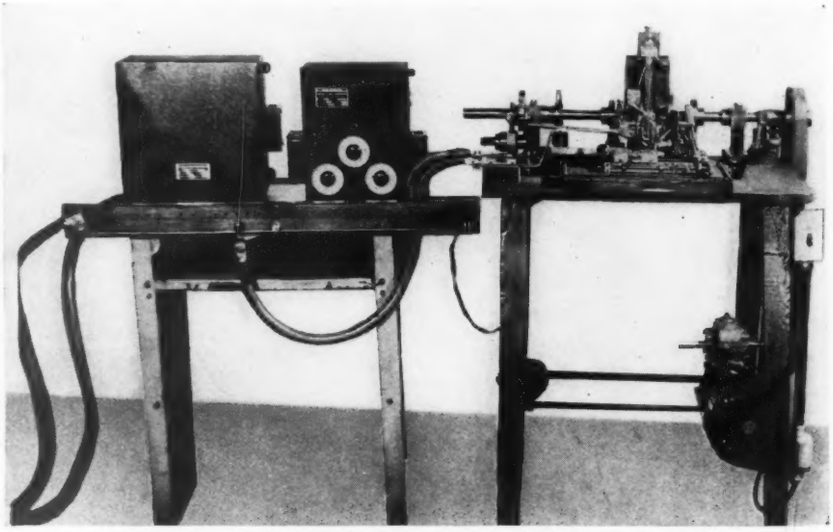
To simplify installation and provide metal-clad construction, bus runs in sections were built for installation between transformers and switchgear at the Carnegie-Illinois Steel Corporation plant at Gary, Ind. Rated at 2,000 amp., 85 sections, each 10 ft. long, 16 in. high and 24 in. wide, were required for the installation.



Westinghouse

Construction of metal-clad buses affords heavy bracing

The metal-clad bus sections are each provided with removable covers over the end sections or joints, making the connections easily accessible. Micarta supports insulate the conductors and carry them rigidly in position. Joints between bus sections are made by silver-plated splice plates insulated with molded Micrata covers.



Automatic pen point welder with timer control at left

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- **Makes SAFE Protection REMAIN SAFE**
- **Stops loss of money on needless "blown-fuse" service calls**
- **Permits adding more appliances to present circuits**

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Adapter
Price $0.07½

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The adapter locks itself in place—can't be removed without destroying it. Steel spur, like a ratchet, lets adapter screw in but not out. The Fustat can be changed in the ordinary manner.

On new jobs, when buying panels, switches, etc., you can specify that they be equipped with Fustat bases.

	FUSTATS	ADAPTERS
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20 Amp.	920	A20
25 Amp.	925	A30
30 Amp.	930	A30

A15 adapters won't take 20, 25, or 30 amp.
A20 adapters won't take 15, 25 or 30 amp.
A30 adapters won't take 15 amp.

0 to 14 ampere sizes (for motor protection) also obtainable — write for full information.

Every service man knows that 15 ampere fuses frequently blow when washing machines, refrigerators, oil burners and other motor driven devices start.

Every appliance dealer knows that such needless blows require many useless service calls—just to replace a fuse.

Every Central Station knows every useless shutdown causes loss of revenue and *worse still, loss of confidence in things electrical.*

and ***Everyone in the electrical industry*** will readily admit that something must be done to stop such blows—but *it must be done without loss of safety.*

Certainly we can't afford to have flexible cords flame up when shorted, just to meet the problem.

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must **RESIST** tampering and overfuseing.

must **OPEN QUICKLY** on short-circuits or other dangerous overloads.

but

must **NOT OPEN** on motor starting currents or other harmless overloads.

and isn't it clear that . . .

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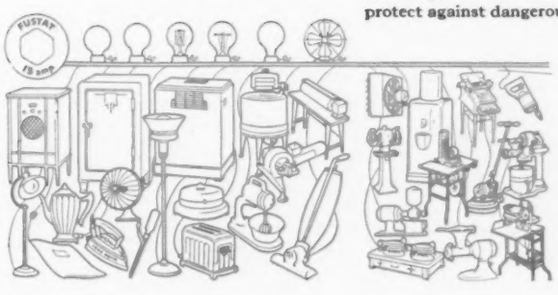
For what device other than a Fustat can—make SAFE protection REMAIN SAFE. . . . Positively protect against dangerous cord shorts as well as overloads. . . . and Eliminate needless blows.



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Building Up THE LOAD

New ideas and practices in selling electrical equipment and service to commercial and domestic customers

Summer Comfort From Home-made Air Cooler

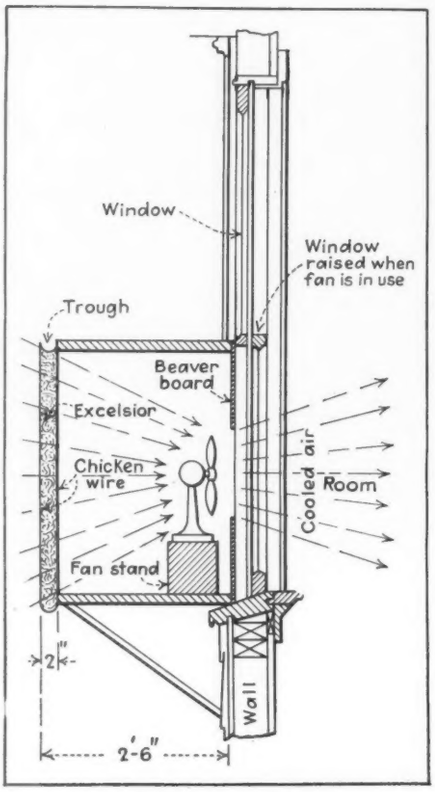
By L. H. MITCHELL
Field Supervisor
U. S. Bureau of Reclamation

An effective means of increasing the comfort in rooms and sleeping quarters, particularly in a hot, dry climate, is provided by the home-made air coolers used successfully on Southwestern construction projects. More than a thousand of these units were used on the Salt River project in Arizona. They are so simple to construct that almost every one will have the necessary parts on hand to build them.

The cooler consists of a wood box which is made to fit tightly in the lower half of a window. The outer end of this box is fitted with an excelsior pad held in place by chicken wire. A tin trough, perforated to spread water across the top of the excelsior pad, and a good-sized electric fan complete the material required.

A small amount of water, admitted under the tin trough, moistens the excelsior. The fan draws air through the moist excelsior and forces it into the room; in this manner, the room temperature may be lowered 10 to 15 deg.

The excelsior must be loose enough to permit the fan to draw a large flow of air through the box. After long-continued use it may become sour and should be changed regularly to avoid contaminating the air with objectionable odors. From 25 to 100 gal. of water is required daily, the amount depending on the number of rooms to be cooled and also upon the temperature and moisture content of the air outdoors.



Home-made Air Cooler
Cross-section of the simply-made air-cooling unit popular in the Pacific Southwest.

Since this type of cooler raises the humidity of the cooled air, it is not particularly suited to hot, humid climate.

•

Hatch Eggs for One-fifth of a Cent

Among the enterprises supplied by the Duke Power Company is the Sharon School Enterprises, a branch of the Sharon High School near Charlotte, N. C., that combines a hatchery, cannery, and tannery.

One section of an old garage building has been transformed into a hatchery and fitted with electric incubators of 3,000-egg capacity. Pupils bring eggs to school and for a small fee these eggs are hatched. During the nine months school season last year total energy consumption was 1,753 kw.-hr. The hatchery turned out 21,870 chicks at a cost of $43.83. Incubation cost was a little less than 0.2 cent per chick.

The cannery has a capacity of two thousand cans a day, affording a market for vegetables and fruits produced by the Sharon farmers and school patrons. In the winter the same equipment tins enough pork and beef to supply the farm folks' needs in the summer.

Farmers find in the school enterprise a market for their hides, which the tannery prepares into useful leather.

•

Uses Lamps for Load Building

During a two-month period the Pacific Power & Light Company disposed of 1,179 Silvray "Lightmaster" units, most of which were in the 150-watt size, retailing them at $2.45, complete with the new silvered bowl Mazda. The merchandising campaign made use of booklets containing data on the Silvray units and on other lighting equipment being featured; these leaflets were distributed among customers and employees and several thousand were also mailed out with

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Reliability, quality, service, these are as much a part of Allis-Chalmers as the engineering talent that incorporates them into every piece of equipment Allis-Chalmers manufactures. But the engineering task does not end here. For to this combination of three must be added a fourth, SAFETY. Excellent example of this principle is Allis-Chalmers Armorclad (Metalclad) Switchgear . . . safe for operators, safe for equipment, outstanding in performance. Allis-Chalmers Armorclad Switchgear combines into one metal encased, compound filled, factory built and assembled unit, all necessary apparatus to make a complete three-phase oil circuit breaker installation.

780

SWITCHGEAR DIVISION

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monthly bills. In addition, the selling plan was based on active co-operation with dealers in the territory.

The feature of this campaign, the company says, is that it effectively introduces the 150-watt silvered bowl Mazda for general home use and is not limited to a single room in its application, as may be the case where a promotion of the floor lamp type of equipment is involved.

The activity is interesting from a load-building standpoint in that an expenditure of a few dollars on the part of the customer for several of these "Lightmaster" units serves to provide an increased revenue which is said to be equivalent to that derived from the sale of a major electrical appliance.

•

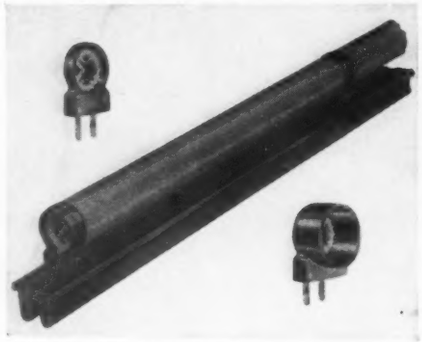
Color Lumiline Adds to Night Club Load

By L. I. WHITCHURCH
Commonwealth Edison Company, Chicago

Even though night spots like Colosimo's in Chicago do not go in for high-intensity lighting, this preference for few foot-candles need not prevent the extensive use of light for decorative effect. As shown by the accompanying illustration such decorative effect may be provided at reasonable cost for installation by the use of lumiline lamps.

Colosimo's was to be rebuilt. Commonwealth Edison lighting engineers were called in for advice on the lighting. A complete plan was furnished and the installation was made by the customer's contractor. The only high-intensity lighting is that used for the floor show. The rest of the room is bathed in soft, varicolored light from four ceiling fixtures, each with twelve lamps that were first 25 watts and then replaced with 15 watts because they were too bright. The principal source of illumination is a continuous strip of lumiline, cove mounted all around the room. The lamps, in colors of straw, orange and two blues, are set in receptacle strip with contact points at 6-in. centers, which works out very nicely with the 18-in. lamps. A parallel strip contains clear lumilines for use when more light is wanted in the room. Altogether there are 506 ft. of luminine, half white and half colored. This is the largest installation of this type of lamp in Chicago.

Although the effort in this lighting job was toward soft, subdued lighting, it was, in spite of that, a very successful load builder. The previous lighting load was 12 kw. Since improvement of both general and stage lighting, the load is now 30 kw.



Receptacle strip used for lumilines

Lumilines light Colosimo's

Home Units Yield $28 per Kw.-Year

The emergence of air conditioning as a load-building item for electric utilities assumed new importance in 1936 as the effect of complete home electrification efforts began to take hold, according to J. J. Donovan, manager of the General Electric air-conditioning department.

Mr. Donovan has revealed that G. E. air-conditioning equipment alone accounted for the use of 10,875,000 kw.-hr. during 1936 through normal use. This estimate is based, it is said, on 11,100 kw. of connected load, derived from definite records of orders received and recognized averages for both kilowatt-hour consumption and revenue, estimated to be approximately $310,000 annual revenue for utilities. This would result in an average usage of 980 kw.-hr. per kilowatt per year and yield $28 per kilowatt per year at the 2.84-cent rate.

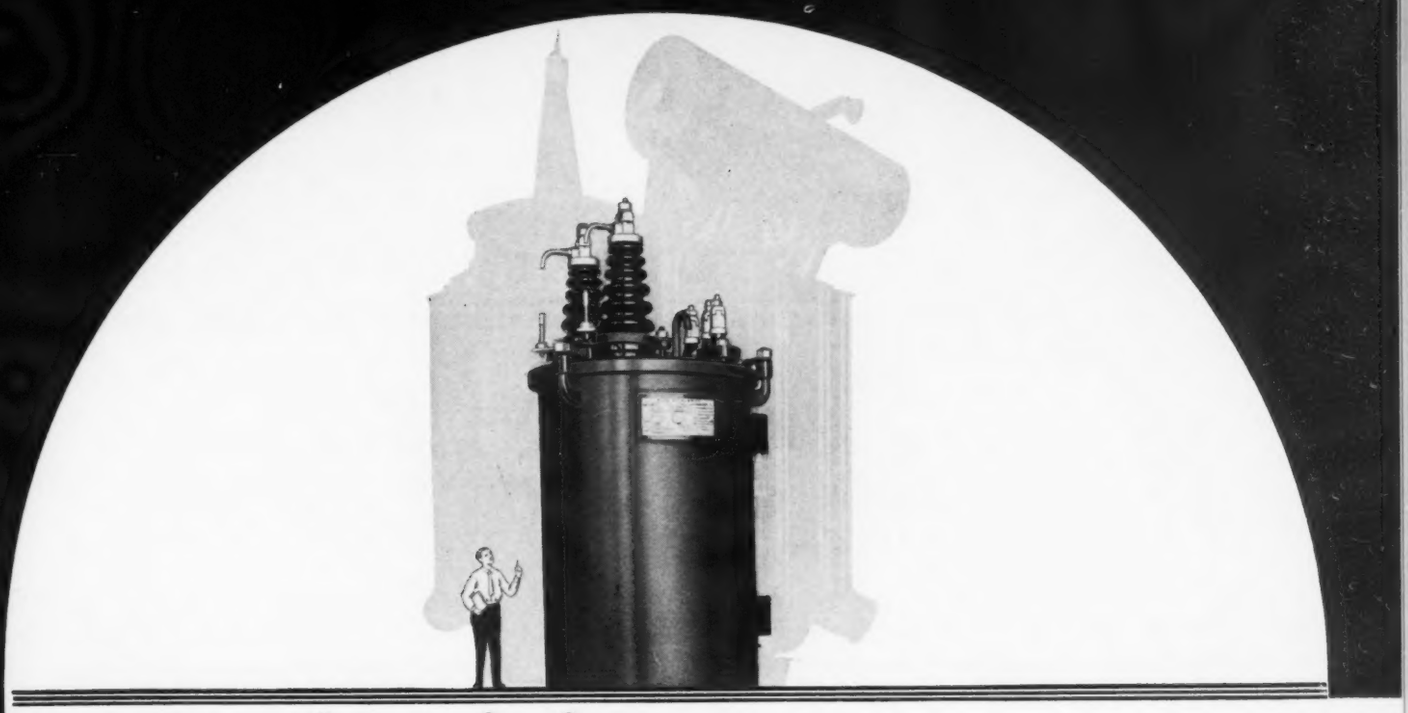
More than 35 per cent of the total kilowatt-hours used by General Electric air-conditioning equipment was accounted for by domestic units, despite the relatively low rate of current consumption per unit. Extensive advertising, promotional service of many kinds and more flexible and better designed equipment are credited by Mr. Donovan for this showing.

•

Custard Cups Bring in Refrigerator Prospects

At the doors of 19,000 non-owners of electric refrigerators in Kansas City, Mo., local dealers' salesmen left 19,000 Pyrex custard cups, each accompanied by a card. The card explained that if it were filled in with the name of a non-owner of a refrigerator and brought in to the store of the dealer named on it five more cups to fill out the half dozen would be presented to the applicant. Himself a non-owner, the applicant would see before him in the store a display of gleaming new refrigerators, and as he accepted his five cups from the friendly salesman he would learn of the amazingly easy terms on which a refrigerator could quickly be installed in his own home.

No record is yet available of the number of prospects who turned up at the dealers' stores, but they are appearing in large numbers, ample to prove that the idea works.



Built like a Power Transformer!

The Moloney Pivot Type Distribution Transformer borrows from its giant brother... the Power Transformer.

By extending the high voltage bushing shanks below the cold oil level... just as is done on the large Power Transformers... there is provided *another* distinct advantage of Moloney Pivots over other types of distribution units.

This submerging of the high voltage bushings in oil eliminates the frequent flashovers that occur from the leads to the tank or to the cover... thereby doing away with the outages normally resulting from this cause.

Moloney Pivot Type Transformers are built with the same infinite care and precision as are the Power Transformers... resulting in added years of trouble-free service and economical operation.

***Specify* MOLONEY TRANSFORMERS**

MOLONEY ELECTRIC
SAINT LOUIS
TRANSFORMERS

New ENGINEERING IDEAS

Discoveries, proposals and developments by electrical engineers and scientists in the field, the factory and the laboratory

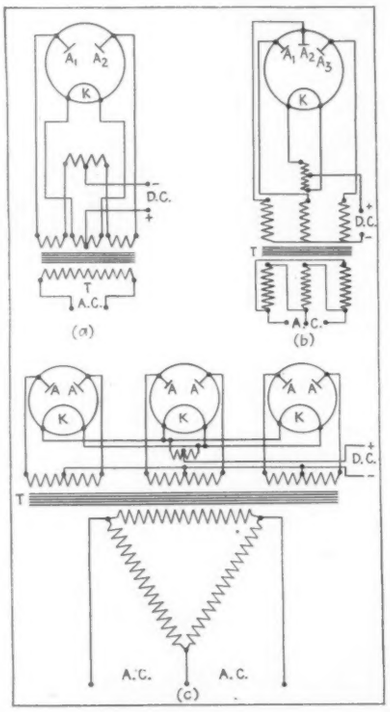
Heavy-Duty Rectifier Uses Oxide Cathode

Oxide-cathode rectifiers formerly limited to small units for charging portable storage batteries are being made in England in large sizes for heavy-duty operation. High efficiency, of the order of 88 per cent at full load, and avoidance of the need for external excitation are advantages of this type rectifier, which differs from the mercury-arc type in that the electron-emitting element is a hot oxide-coated filament instead of a mercury pool.

Once the filament of the rectifier is heated and electron flow established, the filament can be left excited at a negligible loss and the load switched on and off at will. Diagrams of single-phase, three-phase and six-phase oxide-cathode rectifiers are illustrated. The diagrams relate to valves with two electrodes giving full wave rectification. Other arrangements than those shown are possible; for example, four-phase rectification from a three-phase supply by using a modified Scott-connected transformer.

It is theoretically possible to design oxide-cathode rectifiers without a main transformer. A small auxiliary transformer is needed, however, for heating the filament. A disadvantage of this design is that d.c. current from the rectifier has to traverse the a.c. mains in order to complete the circuit via the path of lowest impedance (usually the windings of the nearest distribution transformer). For this reason it is desirable to limit the size of this type rectifier to outputs of 10 amp.

Losses of the oxide-cathode rectifier are low, according to a description in the *Engineer*, London. The losses consist of transformer losses, filament consumption and voltage drop in the valve. Filament consumption is about 2.5 watts per ampere of rating and the voltage drop in the valve is from 12 to 15 volts for 250-volt units, it was stated.



Oxide-cathode rectifiers connected for single-, three- and six-phase rectification

(A) With left side of secondary of transformer *T* positive, anode *A*-1 is positive. Current flows from *A*-1 to *K* and thence to d.c. load and back through neutral point of transformer. In second half of cycle the right side of the secondary is positive, current flows from *A*-2 to *K* and follows same path as before. Similarly, in three-anode rectifiers (B) a flow of electrons will be established to whichever of the three anodes is momentarily at highest positive potential. By tapping the secondary, as in (C), and using three two-anode valves, six-phase rectification is obtained.

Radio Scheme Locates Buried Cable or Pipe

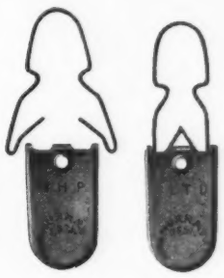
By D. C. MEYER
Consulting Engineer, Mount Vernon, N. Y.

Such typical utility company tasks as locating underground cables, pipe lines, tanks, or manholes ahead of trenching machines can all be allocated to a new radio device for exactly locating buried metal objects. Unlike older schemes for locating pipe lines, this device does not require any physical connection with the line or cable being traced. The Fisher "M-Scope," as the device is known, consists of two self-contained radio units, a transmitter and a receiver, both battery-operated. Since the device requires no electrical contact with the object being sought a 30 per cent saving in time is reported by one Eastern utility over old methods for locating gas mains which required one or more contacts with the main being traced.

A low-power, self-modulating radio transmitter operating on 175 kc., modulated with an audio frequency of 1,000 cycles, is separately mounted with a receiver having a balanced loop synchronized to the same wavelength as that of the transmitter and coupled to the input of the receiver. In operation the transmitter sends out 175-kc. waves which are induced in the pipe or cable being traced when the transmitting loop aerial is placed vertically parallel to and over it. These waves travel along the main for a limited distance and can be picked up by the re-

OUTSMART THE PILFERERS

DIAL MANIPULATORS AND JUMPER EXPERTS CAN BE DETECTED AT TRIFLING EXPENSE



INSTALL THE TAMPERPROOF MURRAY PADLOCK SEAL AND STOP LOSSES THROUGH CURRENT DIVERSION . . .

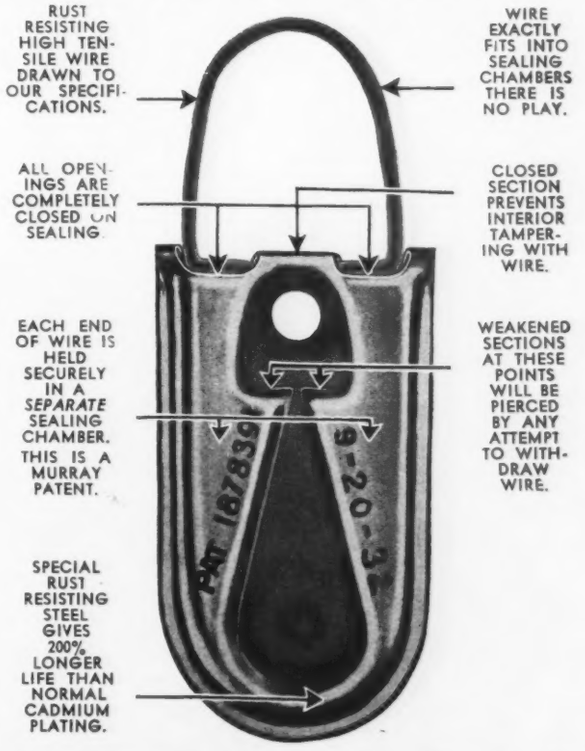
There isn't a lighting company that disregards the need for sealing customers' services and temporizing in that point is unnecessary, but the experience of MURRAY PADLOCK SEAL users prove the fallacy of the statement that one seal is as good as another. It is definitely in MURRAY PADLOCK SEAL performance that differences become apparent.

Protection by detection—the successful way to guard against dollar-leakage through energy diversion.

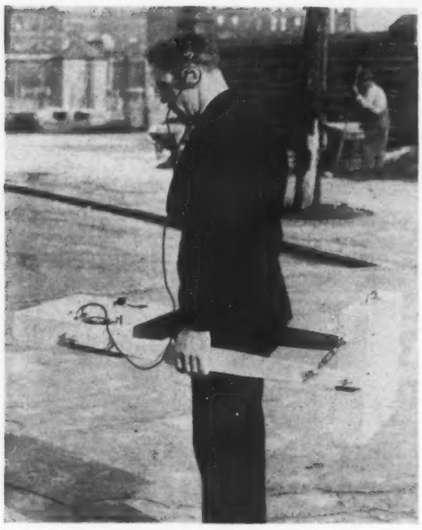
You can be sure of presumptive evidence of theft with this seal. It has the appearance—the effect of a policeman on guard. It denotes the legal viewpoint and figurately says "Stop Thief." The needed evidence to combat current diversion through safeguards this seal affords, makes detection of tampering certain.

Your revenue deserves the protection of the Murray Padlock Seal. Details of this unique sealing system will be gladly sent on request.

METROPOLITAN DEVICE CORPORATION
1250 Atlantic Ave., Brooklyn, N. Y.


RUST RESISTING HIGH TENSILE WIRE DRAWN TO OUR SPECIFICATIONS.
WIRE EXACTLY FITS INTO SEALING CHAMBERS THERE IS NO PLAY.
ALL OPENINGS ARE COMPLETELY CLOSED ON SEALING
CLOSED SECTION PREVENTS INTERIOR TAMPERING WITH WIRE.
EACH END OF WIRE IS HELD SECURELY IN A *SEPARATE* SEALING CHAMBER. THIS IS A MURRAY PATENT.
WEAKENED SECTIONS AT THESE POINTS WILL BE PIERCED BY ANY ATTEMPT TO WITHDRAW WIRE.
SPECIAL RUST RESISTING STEEL GIVES 200% LONGER LIFE THAN NORMAL CADMIUM PLATING.
PAT. 1873
9-20-32

MURRAY PADLOCK SEAL



Portable radio device locates cables and buried pipe lines

The operator is facing the receiving unit of the instrument. The transmitter in the vertical position sends half its radiations upward into the air and the other half down into the ground, where they are induced in the object being traced. A maximum tone is heard when the operator is over the object.

ceiver until they are all damped out.

To insure that the signals are being picked up from the main and not from the transmitter the receiver should be kept 25 to 30 ft. from the transmitter.

In general, the M-Scope may be used in three ways:

Assembled with the receiver horizontal and the transmitter vertical as shown in the illustration. The operator takes the position shown and walks over the area to be surveyed. A mark is made at the point where a maximum tone is heard in the headphones and a minimum reading obtained on a plate current milliammeter in the last audio stage of the receiver. The operator then retraces his steps and again makes a mark at the point of maximum tone and minimum reading. Half the distance between these marks is over the center of the object being located.

Receiver and transmitter separated and each carried vertically and parallel by an operator. To find the pipe or cable, operators walk across the street, keeping 40 ft. apart and equidistant from the same curb. Maximum tone is again heard when the transmitter and receiver are over the cable. The transmitter is then placed on the ground over the cable and parallel to it and the operator with the receiver backs away from it along the cable, marking its location as he goes at points where maximum tone is heard.

With the receiver held horizontally instead of vertically a minimum tone volume or null indicates the location of the object. Some find this method more distinguishable and accurate than the method in the above paragraph, although the technique is the same.

•

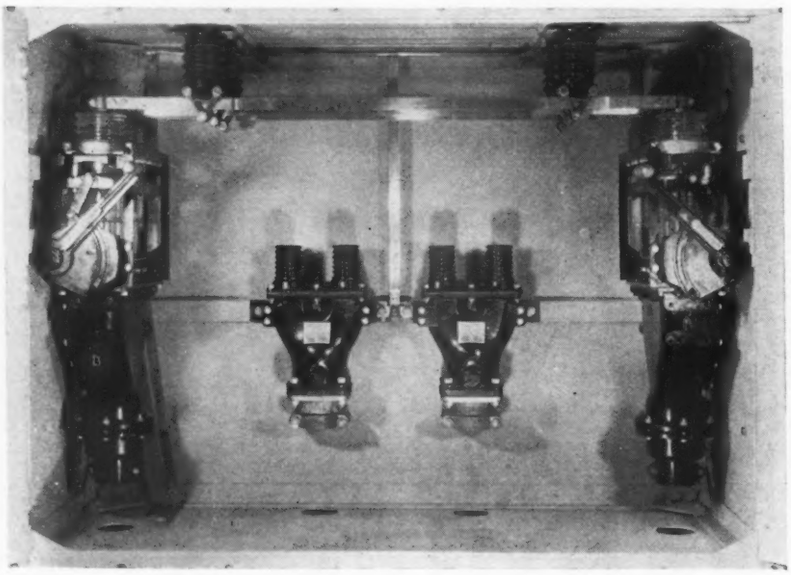
Isolator End Bells Save Cabinet Space

By R. T. CALLOWAY
Electrical Engineers Equipment Company, Melrose Park, Ill.

A scheme for combining cable terminal and disconnecting means in one piece of equipment has now made possible the use of considerably smaller cabinets for switching assemblies and has resulted in a marked saving in housing cost. This scheme was used recently in a number of switching cabinets built for a customer to meet special requirements.

From each cabinet were to be taken two single-phase, 6,600-volt feeders for lighting and small motor supply and in each case these two feeders had to have throwover service to a stand-by line. How the problem was worked out in very small space and still maintain standard clearances of live parts appears in the accompanying illustration. If the usual cable end bell and open blade disconnecting switch assembly had been used the steel cabinets would have had to be twelve or fifteen inches longer and about ten inches higher than was necessary in the present design.

As shown, the isolator cable terminals are mounted on the end walls of the cabinet with a bus across the top connecting them. The bus may thus be energized from either of the entering three-phase lines. The feeder cable end bells are fixed to the back wall of the box with taps to be brought down from the bus at the top. The bus and the tap connections will be thoroughly taped so to prevent any workman from making accidental contact with live parts. Another feature of the job is the use of glass bushings on the isolator contacts in this way making it possible for the operator to see the position of the contacts at all times.



Compact feeder tap assembly

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Compact Transformer Converts to A.C.

The Elsome-Jones d.c. transformer has been developed in England in response to a demand for a simple, compact, portable machine for changing low-voltage d.c. supply to a.c. Details in the *Electrician* (April 9, 1937) indicate that it is a combined motor and closed-core transformer in one unit in which the primary of the transformer serves also as the field coil of the motor. A rotary, non-magnetized flywheel, which controls a commutator, is imposed between poles in the primary of this newly developed transformer.

The total motor flux is passed through the primary of the transformer and the flux supply of the motor poles is only a fraction of the flux passing round the core of the transformer. Motor speed, and consequently frequency of the output, is controlled by adjustment of the brush gear, or timing.

At present these units are fitted in a compact aluminum casing and sold for operating neon signs on vehicles. The storage battery on the vehicle furnishes the energy necessary for operation.

Monitor *Fan Control—*

for

U. S.

COURT HOUSE

ARCHITECTS
EDWARD B. GREEN and BLEY & LYMAN
Buffalo
CONTRACTORS
FLEISHER ENGR. & CONSTR. CO.
Minneapolis
VENTILATING ENGINEERS
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Buffalo

Monitor

AUTOMATIC
ELECTRIC MOTOR
CONTROL

Monitor builds a wide range of standard starters, automatic controllers, and accessories — also custom built apparatus for any electric motor control problem, no matter how complex. Monitor sales engineers in principal cities will gladly consult with you. Write us.

Many of the public buildings erected by the Government are using Monitor control equipment on fans, pumps, etc. The above illustration is of the ventilating fans and control in the United States Courthouse at Buffalo, New York.

These controllers will operate the fans at either low speed, or high speed with complete protection to the motors at all times.

Monitor builds a complete line of controllers especially designed for ventilating fan service . . . Standard features of design include: Automatic acceleration to selected speed, push button control — full selective with pilot-light indication of speed, speed regulation, thermal overload protection, low voltage protection, in addition to the special mechanical and electrical advantages ever present in Monitor automatic control.

(Write for Bulletin No. 7509)

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MonitorControllerCompany

Gay, Lombard & Frederick Sts.
BALTIMORE, MARYLAND

News ABOUT PEOPLE

Consumers Power Elects F. G. Boyce Vice-President

Frank G. Boyce, manager of electric production and transmission of the Consumers Power Company has been raised to the rank of vice-president

through action of the Board of Directors.

"The directors felt that the fine work done by Mr. Boyce in a position of tremendous responsibility entitled him to this recognition" said Dan E. Karn, Vice-President and General Manager.

Mr. Boyce joined Consumers Power Company twenty years ago as assistant manager of the production and transmission department. He succeeded the late Bryce E. Morrow as manager in January 1936.

A native of Booneville, New York, he began his career in the electrical industry with the Allis-Chalmers organization in Milwaukee. Subsequently he joined Stone & Webster of Boston, Mass., as superintendent in charge of substation construction. Still later he was electrical engineer for the Milwaukee Electric Railway & Light Company, and for the Goodyear Rubber Company at Akron, Ohio.

He is a member of the American Institute of Electrical Engineers and of the American Society of Mechanical Engineers.

•

▶ EDWARD B. FIELDS, New York and Queens Electric Light & Power Company, was elected treasurer of the Purchasing Agents Association of New York.

MURRAY WHITFIELD, formerly manager of sales of the electrical division of Steel & Tubes, Inc., has become general sales manager of the Appleton Electric Company, Chicago, in charge of sales of all of this company's line of electrical and automotive products. Mr. Whitfield entered upon his business career with the Economy Fuse & Manufacturing Company. After several years he joined the Jefferson Electric Company sales organization, where he remained for three years, leaving that company to organize an electrical division sales department for Steel & Tubes, Inc. in 1929, when that company decided to introduce electrical metallic tubing to the electrical industry.

John B. Blandford, Jr., who recently became general manager of the Tennessee Valley Authority. For nearly four years he served the Authority in an administrative capacity

H. F. Boe of Westinghouse Made Commercial Manager

Appointment of H. F. Boe as commercial manager of the Westinghouse Electric & Manufacturing Company has been announced. Mr. Boe will

have two headquarters, one in the Union Bank Building at Pittsburgh, the other at 150 Broadway, New York. In addition to being responsible for the sale of Westinghouse products in the eastern district, Mr. Boe will now direct the commercial activities of the apparatus divisions.

A native of Mansfield, Ohio, Mr. Boe has been associated with Westinghouse since 1900. For the first 14 years of his career he was active in East Pittsburgh headquarters works, engineering and sales departments. Later he went to Rochester, N. Y., then to Buffalo, and in April 1935 was transferred to New York, where in May 1936 he became eastern district manager.

He is a member of the American Institute of Electrical Engineers, Electrical Association of New York, and the New York Electrical Society.

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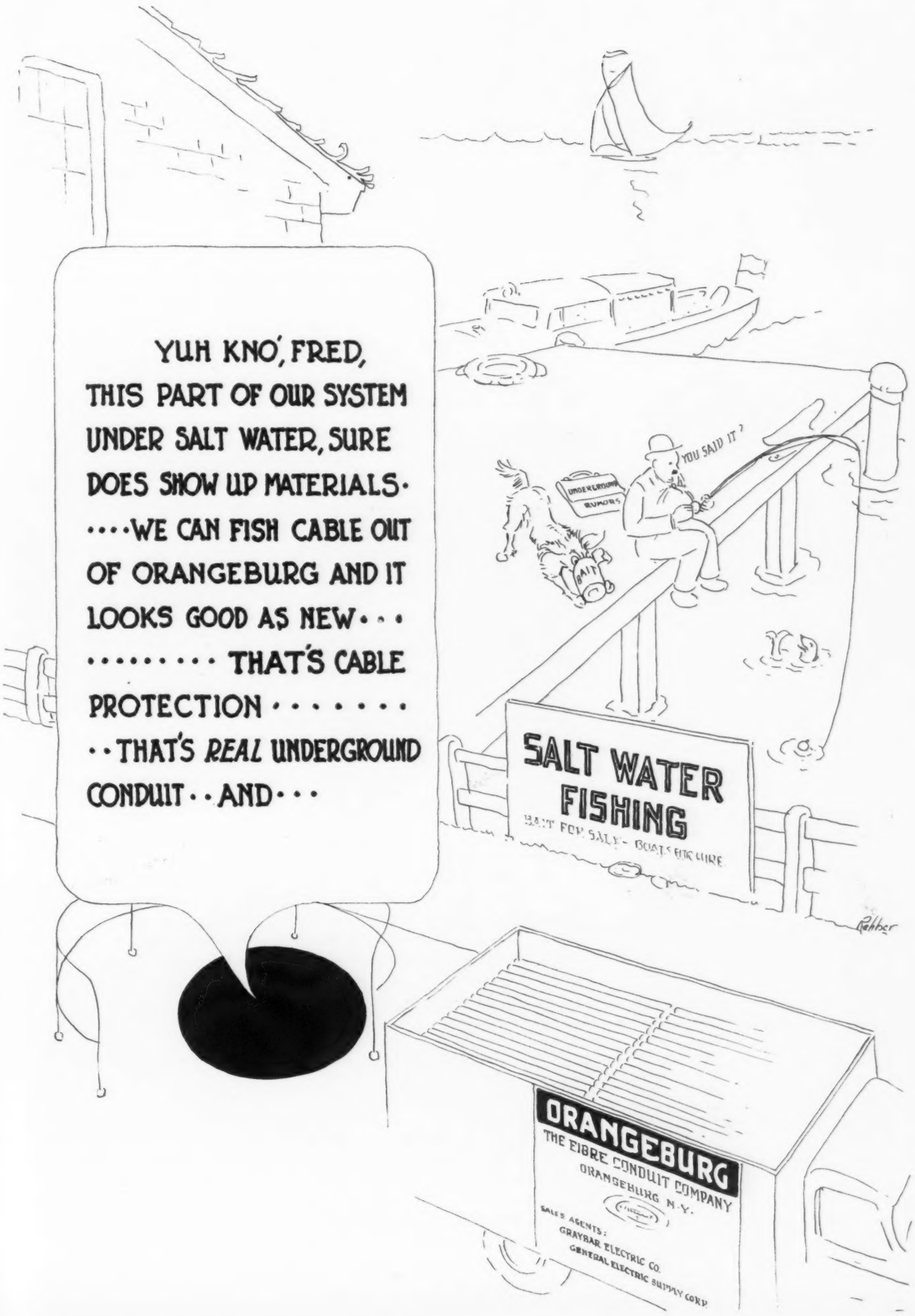
JAMES V. TONER has been elected treasurer of the Boston Edison Company.


YUH KNO', FRED, THIS PART OF OUR SYSTEM UNDER SALT WATER, SURE DOES SHOW UP MATERIALS· ····WE CAN FISH CABLE OUT OF ORANGEBURG AND IT LOOKS GOOD AS NEW··· ····· THAT'S CABLE PROTECTION ····· ··THAT'S REAL UNDERGROUND CONDUIT··AND···
YOU SAID IT!
UNDERGROUND RUMORS
BAIT
SALT WATER FISHING
BAIT FOR SALE - BOATS FOR HIRE
Rehber
ORANGEBURG
THE FIBRE CONDUIT COMPANY
ORANGEBURG N.Y.
SALES AGENTS:
GRAYBAR ELECTRIC CO.
GENERAL ELECTRIC SUPPLY CORP

E. B. Newill and S. M. Schweller of Dayton Get Promotions

Promotion of E. B. Newill, chief engineer and director of research of Frigidaire Division, General Motors Corporation, to assistant general manager, and S. M. Schweller, assistant chief engineer, to chief engineer and director of research has been announced.

E. B. Newill

Mr. Newill also becomes assistant general manager of the Frigidaire and Delco-Frigidaire conditioning divisions of General Motor Sales Corporation, which market the refrigerating and air-conditioning equipment manufactured by Frigidaire and Delco appliance divisions. His elevation to general management rank marks the ascendency of a man of the research type of mind who has broadened his knowledge to include experience in the problems of production, sales and other phases of a large manufacturing and marketing organization. Before becoming identified with General Motors in 1929 Mr. Newill was connected with the Westinghouse Electric & Manufacturing Company.

S. M. Schweller

Mr. Schweller joined Delco in 1916. In 1925 he was made general foreman in charge of all Frigidaire assembly operations. Three years later he was made assistant chief engineer in charge of product development, a department which was later broken down into household, commercial and air conditioning sections with Mr. Schweller in charge of household development. In 1934 he again became assistant chief engineer, the place he relinquishes to take over the top post in the division's engineering and research section.

•

F. E. Barth Elected President of Graton & Knight Company

Frederick E. Barth, vice-president of the Graton & Knight Company, Worcester, Mass., has been elected president of the company, succeeding the late Frank H. Willard.

Mr. Barth entered the industrial field as a staff member of the L. L Harr Corporation, production and accounting engineers of New York. He went to Worcester in 1917 to perfect production methods for Graton & Knight. In 1919 he was made office manager, general sales manager in 1924 and vice-president in 1926.

•

► DR. ROBERT A. MILLIKAN, one of the leading physicists of the world, returned last week from abroad on the United States liner Washington. Dr. Millikan lectured in Ireland and the Scandinavian countries. Before returning to his laboratory at the California Institute of Technology, he visited Philadelphia and received the Franklin Institute's medal for his scientific contributions.

OBITUARY

Dr. Peter W. Sothman

Peter W. Sothman, electrical engineer who had been prominently identified with large power projects in many parts of the world, died in Germany last week, at the age of 67.

A Dane by birth, Mr. Sothman received his technical education in Germany and soon thereafter became associated with Siemens & Halske. Subsequently the German General Electric Company appointed him chief engineer for large power plants. In this connection he went to Strasbourg, where he pioneered in parallel operation of alternators, the system ultimately becoming one of the most prosperous in Europe. In 1906 he was chosen chief engineer for the Ontario Hydro-Electric Power Commission, where he laid the foundation for the present system.

After engaging in some large and important work in the United States, Canada and South America he went to the Irish Free State to engage in the Shannon River development. The project was completed in 1930. He returned to Germany with the Siemens-Schukert Works, but retired in 1931. Mr. Sothman was a fellow of the A. I. E. E.

WILLIAM R. WHITTINGHAM, resident manager of the Millburn division of the Jersey Central Power & Light Company, died June 24 after a long illness. He was 77 years of age. Mr. Whittingham took a position with the Millburn Electric Company, which had been organized by his brother, in 1898. He remained as resident manager of the Millburn office when the Jersey Central System took over the property in 1925.

HERBERT A. STUTCHBURY, general superintendent of the New York State Electric & Gas Corporation at Plattsburgh, N. Y., died of a heart attack June 22 in his office. He was 70 years old. As a young man Mr. Stutchbury joined the Rochester Gas & Electric Company. Subsequently he served for several years as general superintendent of the Yonkers utility before becoming superintendent of the Plattsburg Light, Heat & Power Company thirty-one years ago.

The Result OF 18,000 TESTS

The high efficiency of Hemingray Brass-shed Glass Insulators, their dependability, extra-g life, and low cost are the direct result of exhaustive search, accompanied by more than 18,000 of the most rous tests you can imagine, and followed by exten-e manufacturing development.

There was no guesswork in developing this modern lator, and there is no guesswork in its manufacture, precision process control and continuous inspection testing mean product uniformity that assures wholly isfactory performance.

If you are not now using Hemingrays, order some ay from your jobber or write to us for samples. Sub-them to the most gruelling tests you know of and for yourself how they can take it. Make Hemingrays ve to you that their performance in service backs the judgment of the man who buys them. They're ilable in clear or brown glass and in ratings up to 000 volts. Owens-Illinois Glass Company, Hemingray sion, Muncie, Indiana.

- Brass-bushed for greater strength, perfect threads and full protection against pin expansion.
- Hemingray provides many advantages: greater mechanical strength . . . sustained dielectric strength . . . unaffected by sudden temperature changes . . . withstands maximum insulator pin expansion . . . never ages or deteriorates . . . controlled uniformity of product . . . all surfaces impervious to moisture . . . tougher—withstands rough handling . . . clear, flawless for easy inspection.

OR MODERN POWER LINE INSULATION

Order HEMINGRAY Glass INSULATORS

Manufacturing AND MARKETS

Sangamo Employees Back Warrant Plan

The "Service Warrant" plan of the Sangamo Electric Company, profit-sharing plan which bases extra compensation to employees on dividends paid on the common stock, has worked without complications since its inception nearly two years ago, according to R. C. Lamphier, president. Both employees and company find it more satisfactory than customary bonus schemes, he declared.

The plan consists in issuing to each employee, with two or more years service, warrants entitling him to cash payments equivalent to the dividend paid on four shares of common stock multiplied by his years of service. Should the company realize a profit without making payment of dividends on the common stock, no payment is entailed. The parent company at Springfield, Illinois, now employs about 1,300.

Mr. Lamphier stated that the plan entails no investment on the part of the employees, no financial responsibility of any kind, no participation in ownership of the company and no continuing rights to an employee on leaving the company or to his family after the employee's death.

•

Electric Appliance Drive Planned by N.E.M.A. Group

An intensive campaign, designed to increase the use of electrical appliances among farmers and centering around the idea of talking to the farm dweller in his own language, is planned by the Rural Electrification Bureau of the National Electrical Manufacturers Association.

Letters have been sent to 800 rural weeklies in twenty-three states having the lowest percentages of electrified farms and yet the highest percentages of farm buildings valued at $500 or more. These letters ask if the editors are interested in publishing short contributed articles telling of specific savings reported by farmers through the use of electrical equipment and giving names, dates and places. Trade periodicals, 4-H clubs, and the National Farm and Home Hour are other proposed mediums to be employed.

•

Manufacturers Name New Representatives

Among the recent sales assignments made by electrical manufacturing companies are the following:

Allen-Bradley Company, Milwaukee, has appointed the Nickerson Machinery Company, Salt Lake City, to handle its line of motor control equipment in Utah, southern Idaho and western Wyoming.

Steel & Tubes, Inc., has appointed Howard H. Loving new representative in Kansas City.

Graybar Electric Company has appointed Martin Buehler manager at Dallas. He was formerly manager at Minneapolis. Earl Sharpe, formerly assistant manager at Minneapolis, has been appointed manager.

Ajax Flexible Coupling Company announces the addition of three sales offices in Akron, Kansas City and Seattle. Beese & Terry will represent Ajax in Akron, Arthur D. Schwartz will cover Kansas City territory and W. F. Nichols serves the area centering around Seattle. Roloff Engineering Company has been appointed Milwaukee sales representative.

McGill Manufacturing Company has announced that V. L. Warren, who is located in Minneapolis, will take over the sales for the electrical division for the states of Minnesota, North and South Dakota and northern Wisconsin. Al Schultz will travel the states of Missouri, southern Illinois, Indiana, Kentucky and western Ohio direct from the factory in Valparaiso, Ind.

•

Stove Business Shares Gain

Standard Electric Stove Company, Toledo, reports an increase of 60 per cent in volume of business over 1935. Expansion of plant during recent months has added 20 per cent to floor space.

G.E. Lamp Department Plans Sales Meeting

More than 250 lamp and lighting salesmen and executives are expected to attend the three-day general sales conference of the seventeen sales divisions of General Electric's incandescent lamp department, to be held August 24-26 at Nela Camp, Nela Park, Cleveland. Besides discussing lighting and sales problems, the field force will join with Nela Park executives in formulating plans for next fall and winter and will also visit the lighting research laboratories.

Co-operating with O. H. Young, in charge of general sales promotion activities for the department, are co-chairman F. S. Hutter of the lamp department's continental division. Philadelphia, and H. L. Smith, of Midland division, Chicago.

•

Supplies Power Generator

Canadian Westinghouse Company, Ltd., advises that it is supplying the generator for the Ruskin power development of the British Columbia Electric Railway Company. It was reported in the June 5 issue of ELECTRICAL WORLD that Canadian General Electric was supplying the generator.

•

Oil Burner Shipments and Orders Show Gain in April

Sharp gains in the number of orders and shipments of oil burners during April was reported by the Department of Commerce. April orders totaled 15,361 units, as against 10,541 a year ago, and 8,576 in April, 1935. Shipments during April totaled 14,682 units, as against 10,210 a year ago, and 8,615 in April, 1935.

For the four months ended April

20 YEARS AGO THIS MONTH
THE FIRST FORD TRUCK WAS BUILT

TODAY . . . FORD LEADS THE WORLD IN TRUCK-BUILDING EXPERIENCE

The first Ford truck was built July 27, 1917. Because it was built of materials stronger but lighter than those in common use, it combined ruggedness and reliability with low operating cost. Because it was sold in large numbers, its price was low. It was the first low-priced truck of quality, and it met with immediate success. Since 1917, Ford has built more trucks and commercial cars than any other manufacturer . . . more than four million units. Measured in years or in units, Ford leads the world in truck-building experience.

Such experience has enabled Ford engineers to improve the Ford truck year after year. The 1917 model was 40 horsepower and sold for $600. Today's Ford V-8 Truck gives you 85 horsepower and sells for nearly $100 less. Road speeds of 70 miles an hour . . . nearly double the speed of the 1917 model . . . are possible with today's Ford truck. Frames, springs, axles, clutches and wheels have been strengthened for greater load-carrying ability. Safety has been increased by the use of an all-steel cab and Safety Glass.

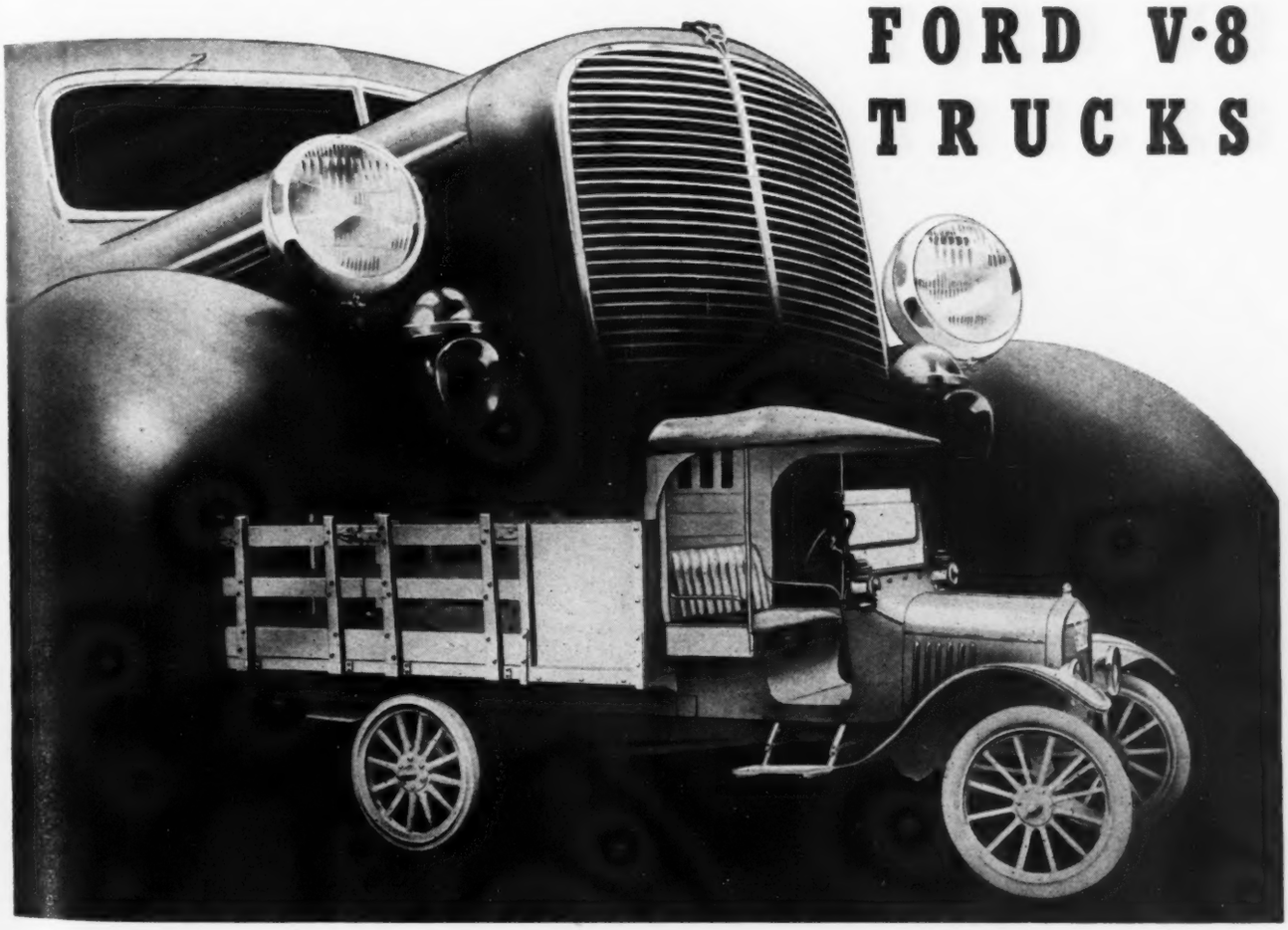
And as for ECONOMY . . . today's Ford V-8 Trucks show the lowest ton-mile costs of any truck in Ford history.

Try a Ford V-8 Truck under your own operating conditions. Ask your Ford dealer for an "on-the-job" test of an 85-horsepower Ford V-8 Truck if your loads are heavy . . . or for light delivery service with frequent stops, try the thrifty new 60-horsepower Ford V-8.

Ford

Convenient, economical terms through Authorized Ford Finance Plans of the Universal Credit Company

FORD V·8 TRUCKS



30, shipments totaled 48,212, against 34,197 in the same period last year, and 23,320 in the first four months of 1935.

•

Power Generating Machinery Exports Show Gain in April

Exports of power generating machinery in April were more than 112 per cent above a year ago, even with electric and automotive machinery eliminated, according to figures made public by the Machinery Division, Department of Commerce.

Exports for the month totaled $1,427,898, as against $672,139 a year ago. The increase was noticeable in mechanical drive turbines, locomotives, steam boilers, Diesel and other engines.

•

Advance in Air Unit Sales

S. F. Myers, manager of air-conditioning sales of the Westinghouse Electric & Manufacturing Company, has reported a gain of 201 per cent in the billing of Westinghouse air-conditioning for the first quarter of 1937 over the same period in 1936.

•

Worthington Signs With CIO

A contract that includes a provision for a forty-hour, five-day week has been signed by officials of the Worthington Pump & Machinery Corporation, its affiliate, the Worthington-Camon Meter Company, and representatives of the Steel Workers Organizing Committee, a CIO affiliate. The contract affects about 1,600 employees of the pump company and about 200 of the meter concern.

•

Watts Regulator Expands

The Watts Regulator Company, Lawrence, Mass., makers of relief valves for electric water heaters and other allied steam and water handling equipment, will shortly occupy a new factory in that city with about double the present productive space.

New York Metal Prices

	June 23, 1937 Cents per Pound	June 29, 1937 Cents per Pound
Copper electrolytic	14.00*	14.00*
Lead Am. S. & R. price	6.00	6.00
Antimony	14.50	14.50
Nickel ingot	35.00	35.00
Zinc spot	7.10	7.10
Tin Straits	55.60	56.875
Aluminum, 99 per cent	20-21	20-21

* Delivered Connecticut Valley.

Field Reports on Business

Reopening of struck steel companies and the back-to-work movement indicates an encouraging outlook for business. Summer dullness is evident in many lines, with hopes that it will not last too far into the fall. Appliance sales are holding up well.

NEW ENGLAND

Orders for more than 3,000 motors were placed in New England during the past week, including more than 2,000 fractional-hp. motors purchased by machine tool manufacturers. Interest in motors from 10 hp. up for pumping and ventilation purposes is quite strong; heavy electrical machinery is less active.

Central station supplies are quiet; some buying for line extensions is proceeding at a normal rate. Approval has been granted by the city of Leominster for the construction of a joint line by Leominster Electric and New England Telephone & Telegraph Company at a cost of $52,000. Western Massachusetts Electric Company, Greenfield, Mass., is resuming normal extension of rural line development and has entered the market for materials.

Street lighting is attracting interest. Air conditioning and oil heating equipment are advancing with the construction of a considerable number of institutional type buildings. Recently an oil-heating project for a Boston hospital, involving about $80,000, was closed. The profitable aspects of air conditioning have been emphasized in a new booklet illustrating installations in Boston Edison territory.

New movie theaters, which will require special lighting effects as well as sound projection equipment, are announced for Brookline and Scituate, Mass. The eleventh annual New England Radio Trade show, held last week at the Copley Plaza Hotel, Boston, was the best show so far, with 50 exhibitors and many sales reported.

NEW YORK

Summer dullness has been thrown into sharp relief as a result of the steel strike. Industrial activity has shown a decided letdown from the year's peak. The continued decline in security prices, with marked inactivity in trading, has led many economists to give thought to its significance. The drop in security prices has led some to express the opinion that it might be forecasting another depression. Others expressed the view that the failure of the government to use its force to restore industrial peace and to curb strikes is the cause of the present unrest and lack of interest in securities.

Electric utilities are continuing their construction programs at a pace none too exciting. Some hedging has been in evidence as a result of the Norris seven TVAs bill. The fact that the subcommittee has gone on record as favoring the bill, regardless of any opposition which might be expressed from utilities or the coal industry, has increased nervousness among utility leaders. Rural electrification is making considerable headway and appliance sales in the communities are going well.

Manufacturers report fairly good business with production holding up, due to backlog of orders. Retail outlets report sales in good volume of refrigerators, fans, cookers and other appliances. Sales of vacuum cleaners are well above a year ago.

Warm weather has been a stimulant to the sales of air-conditioning units in large volume. It is believed by many that air conditioning is now approaching the stage where it is a necessity to certain businesses rather than a luxury.

PACIFIC COAST

June volume of electrical business held up well, and although wholesalers report that unbilled orders are well below those of a month ago they also record such encouraging factors as the arrival of belated warm weather in the Central Valley and slightly decreased labor tension. Dealers record fair response to June campaign for small appliances. Industrial business continues good with several large plants scheduled for early construction in Los Angeles area, such as a $1,000,000 Johns-Manville factory for manufacture of Rockwool and Transite pipe and a $1,000,000 Swift meat packing plant.

Government buying features heavy machinery, such as four heavy oil circuit breakers for Indian service; a $75,000 pontoon generating equipment for dredging Pearl Harbor, Hawaii; a $92,637 award for municipal Diesel plant and distributing system for Seward, Alaska, and an $86,829 award for switchboard, controls and signal panels for Bonneville power house; a $3,500,000 cruiser drydock is planned for Mare Island and aerial surveys are proceeding for the 500 square mile Grande Ronde project near LaGrande, Ore.; $1,467,000 by Westinghouse was low bid for two generators, size 82,500 kva., for Boulder power plant, and Allis-Chalmers bid $1,033,640 for two turbines, size 115,000 hp. San Francisco exposition activity is increasing with three recent bids aggregating $577,000 for various pavilions and dominating towers.

CHICAGO

Sentiment showed little sign of improvement last week as indications of summer dullness, complicated by labor turmoil and reduced purchasing in the troubled area, multiplied. Latest reports, however, indicated a settlement of the strike as a majority of the 22,000 workers in this district desire to get back on the payroll.

Warmer weather spurred retail trade; electric fans moved into prominence, while the demand was extended for refrigerators, ranges and cookers. Retail sales for Chicago independent stores last month were 10 per cent above the previous month and 3 per cent higher than the comparable month last year. The rate of industrial activity slowed down slightly, partially because of labor conditions and seasonal factors. Reports indicate that orders for electrical equipment are holding up surprisingly well in the face of decreasing activity in other fields. Small motor sales are good and wire and cable are moving in good volume. There is a moderate demand for electric tools and small transformer and switch sales are gratifying.

Commonwealth Edison Company reported a 14 per cent increase in earnings over last year for May and 49 per cent for the first five months. Public Service Company of Northern Illinois earnings increased 53 per cent in May and 40 per cent for the five-month period.

Bakelite Laminated Insulation

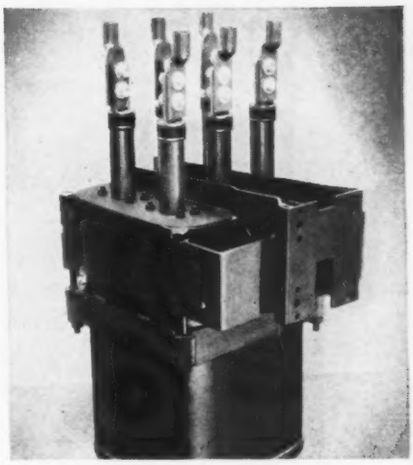
—Adaptable to Many Needs

BESIDES mechanical strength, "shatter-proof" toughness and low power-loss, Bakelite Laminated possesses the merit of adaptability to special designs which might be difficult to produce from other dielectrics.

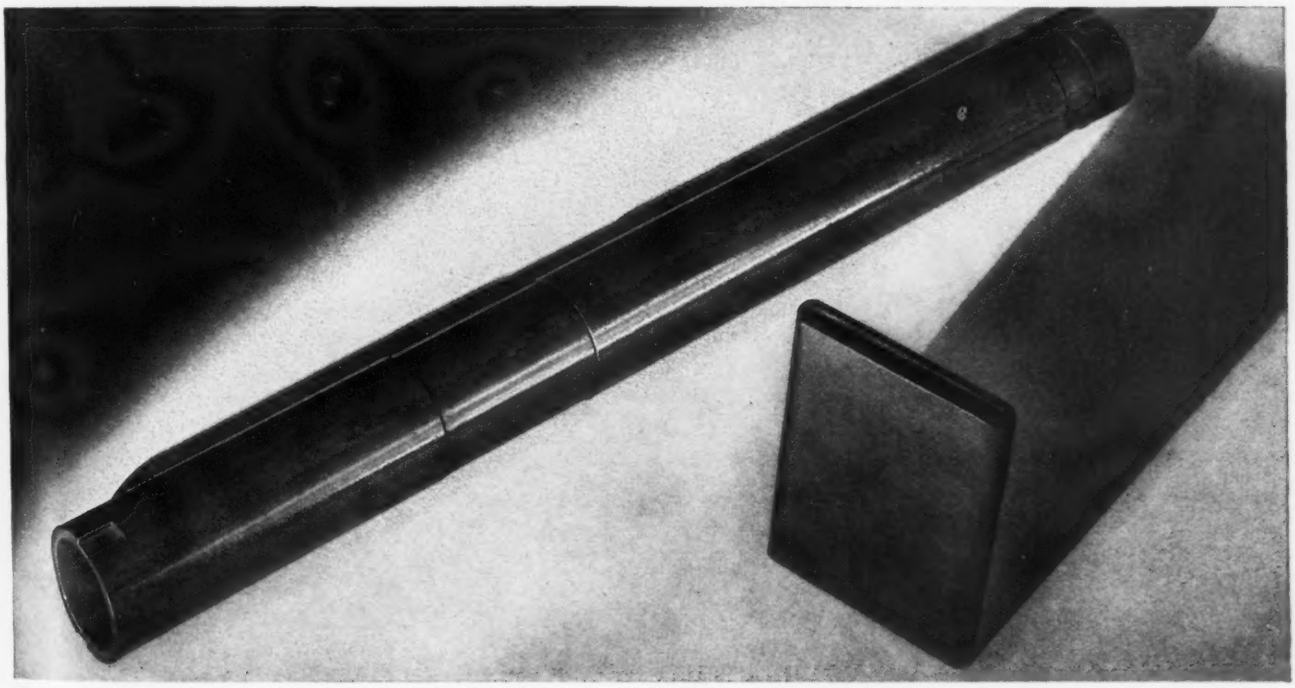
Outstanding examples of this versatility of Bakelite Laminated are the special insulators developed by Roller-Smith Company for oil circuit breakers, bus bars and jumpers. These tubular insulators are formed with built-in metal grounding shields close to the inner surfaces, to prevent corona discharge. Effective grounding is obtained without separate shielding and fastenings.

In numerous other devices employed by electric light and power systems, the unusual combination of properties possessed by Bakelite Laminated provides equally great advantages. This material is comparatively light in weight, mechanically and dielectrically strong, highly insulating, and resistant to moisture, oil, weathering, extreme temperatures, impact and abrasion.

Users and designers of all types of electrical equipment are urged to familiarize themselves with the full capabilities and merits of Bakelite Laminated for electrical insulation. On special problems, our engineers will be glad to consult with you and make recommendations. Write for comprehensive reference booklet 3L, "Bakelite Laminated".



Roller-Smith 75,000 KVA oil circuit breaker equipped with Bakelite Laminated shielded insulators. (Below) Circuit breaker and bus bar insulators of Bakelite Laminated with built-in ground shield.



BAKELITE CORPORATION, 247 PARK AVENUE, NEW YORK, N.Y.

BAKELITE CORPORATION OF CANADA, LIMITED, 163 Dufferin Street, Toronto, Canada *West Coast:* Electrical Specialty Co., Inc., 316 Eleventh Street, San Francisco, Cal.

BAKELITE

REGISTERED U. S. PAT. OFF.

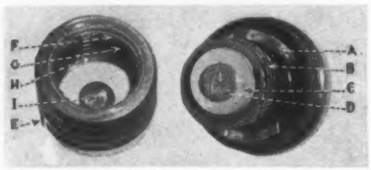
"The registered trade marks shown above distinguish materials manufactured by Bakelite Corporation. Under the capital "B" is the numerical sign for infinity, or unlimited quantity. It symbolizes the infinite number of present and future uses of Bakelite Corporation's products"

THE MATERIAL OF A THOUSAND USES

New EQUIPMENT AVAILABLE

Non-tamperable Fuses

Non-tamperable fuses, announced by three manufacturers, combine a fuse—to protect against heavy, continued overloads—with a thermal cutout—to allow short-time overloads. Under continued overcurrents,



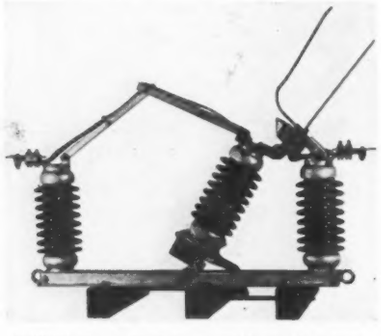
Any bridging in "Fustat" (right) must extend from upper contact bar (A), past screw-toothed disc (B), washer (C), to connect with bottom contact (D), since all parts are insulated from each other. In the adapter (left), bridging would have to extend through saw-toothed upper ring (F) to center contact (I), which must be pressed down before current flows. Lower metal ring (H) is preceded by an insulated section (G). Adapter is locked in by spur (E). Marketed, in 15- to 30-amp. sizes, by **Bussmann Manufacturing Co., St. Louis; National Electric Products Corp., Pittsburgh; and Kirkman Engineering Corp., New York.**

solder in the thermal element softens, permitting a spring to pull the fuse link out and open the circuit. Fusing device screws into an adapter which in turn may be screwed into present Edison cutout bases. The adapter has an external spur that prevents its removal without destruction. Different pitches of internal threads in this adapter prevent the use of fuses larger than the rating of the adapter.

•

Air Break Switch

Greater diversity in mounting is said to be afforded by this new air break switch, offered in two types; Type U, with three insulators per pole; and Type L, with two insulators per pole and the pantagraph on the line side of the strain insulator. Base of switch is arranged for two or three cross arm mountings, allowing a variation in pole size from 6 to 12 in. in diameter, and is also drilled for flat steel mounting in substations. Arcing horns are of the quick-break, non-locking type; pivot-type sleethood protacts and cleans the contacts. Switch pantagraph is designed to allow an angle of take-off up to 30 deg. to switch base.

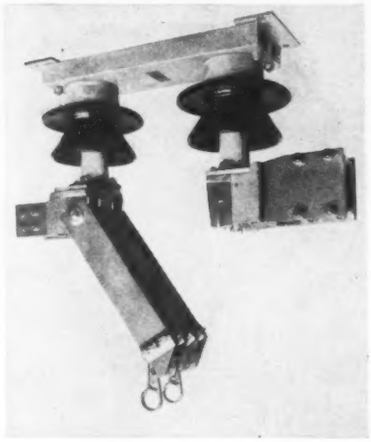


"8900" Type U shown, with station post insulators; both types furnished in ratings of 200, 400 and 600 amp., 7.5 to 69 kv.; in 2, 3 or 4 pole units. **Electrical Engineers Equipment Co., Melrose Park, Ill.**

•

Disconnecting Switch

One terminal of this heavy duty, multiple blade disconnecting switch is arranged for use with copper tubing, the other for flat



Rated at 4,000 amp., 23 kv. **Delta-Star Electric Co., Chicago.**

bars. Design of switch is said to be such that current flows from terminal to terminal in a straight line rather than forming loops characteristic of some of the older designs. Blade locks and silvered contacts are used.

•

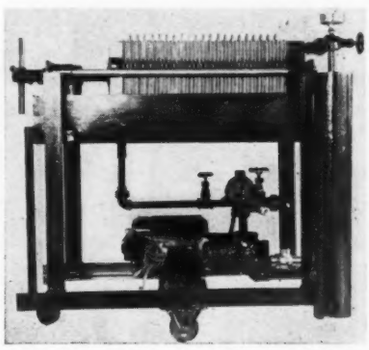
"Disc-Brake" Motors

Both a.c. and d.c. types available; brake mechanism also offered as single unit. **The Reliance Electric & Engineering Co., Cleveland.**

A new power unit, combining in a single unit the functions of a motor with those of a brake, is suggested for use on small cranes, hoists, auxiliary movements on machine tools and similar equipment in which quick, automatic stopping or holding of the load is desired. Brake consists of a disc-type friction device, mechanically and automatically engaged when current is shut off and magnetically disengaged when current is applied. A "wear indicator," combined with the manual brake release mechanism, warns when wear needs to be taken up. Provision is made for varying the braking power.

Oil Filter Press

A new line of oil filter presses for cleaning and drying insulating oils is described as light in weight, quiet in operation and



Standard outfits rated at 5, 10 and 50 g.p.m. for 60 cycle, 220-volt supply. **Westinghouse Electric & Manufacturing Co., East Pittsburgh.**

low in power consumption. Features include a pump bypass through a ¼ in. needle valve to test suction line for leaks; small tank providing a primary gas trap; a discharge flow taken from the bottom of the filter sections providing a secondary gas trap. Drip pan may be removed for cleaning by disconnecting one pipe union and 4 bolts.

•

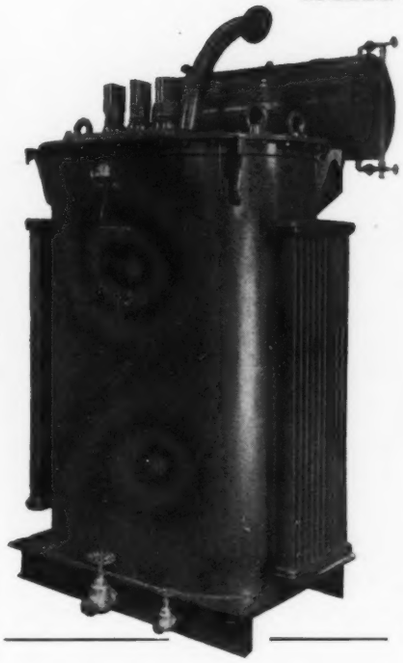
Street Lighting Cutout

Suggested applications for a new cutout for series street lighting circuits include: sectionalizing loops from the main circuit;

"Filmofuse." **W. N. Matthews Corp., St. Louis.**

PRECISE

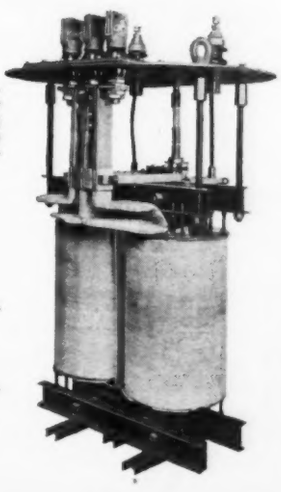
AmerTran offers the utmost in uniformity of product . . .



WHERE a transformer is concerned, precise manufacturing methods are of no lesser importance than correct design specifications. Users of AmerTran Transformers are assured that their equipment is both carefully engineered and properly manufactured. Raw material is tested before fabrication is started; the various parts are checked after each stage of manufacture; finally the completed transformer is subjected to numerous tests to determine its actual operating characteristics under all conditions. Carefully controlled production enables us to prepare accurate performance specifications in advance of manufacture. May we submit data on transformers for your needs?

AMERICAN TRANSFORMER CO.
178 Emmet St., Newark, N. J.

Above—AmerTran Type CC single-phase power transformer complete with all standard accessories.



Right — Core-and-coil assembly of above power transformer — illustrating core-type, single-phase unit with low-voltage secondary.

Write for Catalog No. 116

Ask us about these
FEATURES

1. High turn-to-turn insulation.
2. Linear surge-voltage characteristics.
3. Fully balanced coil design.
4. Coils vacuum impregnated.
5. Rigid core construction.
6. Optimum impedance characteristics.
7. Electrically brazed connections.
8. Tanks pressure tested.
9. External parts rust resistant.

AMERTRAN

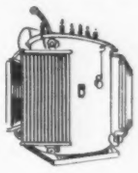
VACUUM IMPREGNATION

Unless moisture and air are thoroughly and permanently removed from the windings of a transformer, the best insulation is of little value. This is effectively accomplished in the case of AmerTran transformers by subjecting the coils to a vacuum-varnish impregnation treatment after a thorough vacuum drying process. Detrimental moisture and air are replaced by insulating varnish which penetrates into all parts of the winding.

Manufactured Since 1901 at Newark, N. J.

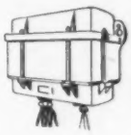
AMERTRAN TRANSFORMERS

a few AMERTRAN PRODUCTS

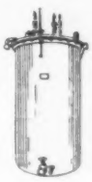


POWER TRANSFORMERS

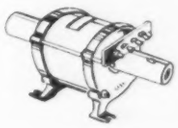
DISTRIBUTION TRANSFORMERS



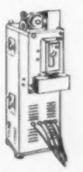
AIR-COOLED TRANSFORMERS



TESTING TRANSFORMERS



INSTRUMENT TRANSFORMERS



VOLTAGE REGULATORS

ELECTRONIC RECTIFIERS

on small series lighting systems where a single constant current transformer operates a single loop, it may be connected to the secondary of the transformer, thus confining danger to the station instead of to the street; it can be put into the line at any point and used as a disconnecting switch under load. Fuseholder drops down below the box to give visible indication that the film cutout has punctured and the 3-amp. fuse blown. Housing is of porcelain and glazed white to distinguish it from primary cutouts as well as to give easy visibility.

•

Time Controllers

Two new models of these instruments, which provide a printed record of productive and down time of any machine or operation have been announced. Model M is pictured; the upper right window shows clock time. The larger window on the left indicates number of units produced. Counts of units produced and the time are printed every ten minutes. When there is an interruption in the work, the knob at the left is turned to a symbol indicating the reason for the interruption. The other and smaller model, Model O, has only one set of digit wheels, which might be arranged to count idle time or units produced.

"Chronologs." Model M shown; designed for 110-120 volt, 60 cycle operation. **The National Acme Co., Cleveland.**

•

Fan-Cooled Motors

Type CP. **Wagner Electric Corp., St. Louis, Mo.**

These totally inclosed, fan-cooled motors have been designed for use particularly in atmospheres heavily laden with abrasive dusts, deteriorating metals and salts, explosive dusts, corrosive gases and extreme dampness in outdoor applications. Motor has skeleton-type stator—deeply grooved on the outside to increase radiation—which is provided with totally inclosed ball-bearing endplates with long machined fits to seal completely the working parts of the unit. Core of motor is in center of frame to permit reversing of endplates and rotor in order to reverse location of conduit box.

•

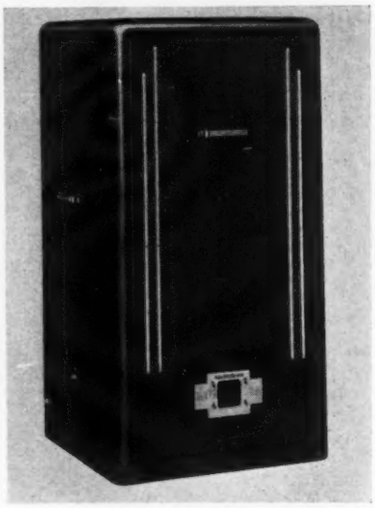
Spot Welding Electrodes

Electroloy Co., New York.

Two new spot welding electrode developments are announced by this company. First, cold formed electrodes, formed under tremendous pressure, are said to have a finer, more uniform grain structure with an additional ten to twelve per cent increase in hardness, minimizing mushrooming or deformation of the tip. Second, plated electrodes have a thin electrically conductive coating of a special alloy resistant to oxidation. This is said to cause less heating of the electrode and consequently less softening and deformation.

Home Air Conditioning Unit

Complete winter air conditioning for this low-priced residential unit includes deodorizing and ionizing in addition to heating.



"All-Year-Air" unit. **Central Manufacturing Division, Auburn Automobile Co., Connersville, Ind.**

filtering, humidifying and circulating. An ozone generator provides the deodorizing feature; an ionizer activates re-circulated indoor air. Summer cooling consists in filtering and circulating outside night air. Cabinet is installed in basement and operates in conjunction with the warm air furnace heating system; it may be adapted for use with hot water or steam heating plants at small added cost, it is stated.

•

High-Lift Truck

With a nested height of 88 in., maximum lift of this new telescoping high-lift truck is 106 in. above the floor. Hoist controller operates through a magnetic blow-out, mill-type contactor which takes all the arcing from the controller itself. It is connected to hoisting mechanism in such a manner that it is automatically returned to neutral at upper and lower limits of platform level. "No-Plug" travel controller is said to prevent instantaneous reversals or starting from a dead stop in the higher speeds.

Type HH-5; capacity, 5 tons; platform dimensions, 26½ in. wide, 54 in. long, 11 in. high, in lowered position. dimensions may be varied to suit requirements. **The Baker-Raulang Co., Cleveland.**

Service Station Luminaire

Totally-enclosed gas-pump-island luminaires are designed to deliver for a given size lamp a maximum amount of light on the area surrounding the pumps while eliminating spotty lighting. A detachable dome-shaped reflector of Alzak aluminum conceals the light source, thereby preventing objectionable glare, while drawing light down through the rippled glass globe, which diffuses it. Unit is equipped with a casting that fits a two-inch pipe; set screws clamp it in place. Either a 300-watt or a 200-watt Mazda lamp may be used, the former being recommended.

Night photo of luminaire installed in gas filling station. **General Electric Co., Schenectady.**

Advertisement

COPPER ALLOY BULLETIN

Reporting News and Technical Developments of Copper and Copper-Base Alloys

JULY — "Bridgeport" BRASS CO. — 1937

"OTHER USES" OF COPPER UP SHARPLY IN 1936

Trends in the uses of copper which were grouped under the heading of "Other Uses" in the chart published in the April COPPER ALLOY BULLETIN, are revealed by an analysis of the figures in the 1936 Yearbook of the American Bureau of Metal Statistics.

Among these "other uses", castings represented the largest in copper consumption in 1936. However, the 1936 figure of 39,000 tons shows only a small increase over figures for the two years previous, and is far below the 1929 peak consumption of 79,500 tons.

Radio, Shipbuilding Gain Sharply

Several other applications show much larger percentage gains. Radio receiving sets, for example, required 24,000 tons last year, compared to 16,000 tons in 1935, and 15,500 tons in 1929. The shipbuilding industry's 1936 consumption of 5,000 tons was almost five times the 1935 figure, and more than double the 1929 quantity. Railway equipment uses rose sharply in 1936, reflecting electrification products and increased use of air-conditioned rolling stock. Air-conditioning equipment, other than railway, used 6,400 tons in 1936, exclusive of electrical equipment.

Miscellaneous uses of copper cover a range of applications too varied to be broken down in detail in the scope of this article. A few of the more important uses are in domestic utensils, electrotyping and engraving, blasting caps, and oil burner tubing. Alloys of copper are widely used for slide fasteners, rivets, and water meters. Rouge boxes, kerosene lamps, and saddlery and harness hardware are a few of the less obvious applications.

The accompanying table gives the complete figures for secondary uses of copper from 1929 to 1936.

ESTIMATED "OTHER USES" OF COPPER IN THE UNITED STATES
(In Tons of 2,000 lbs.)

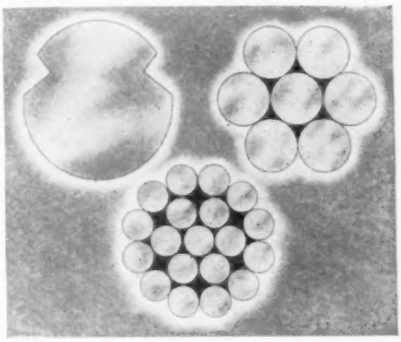
PURPOSE	1929	1930	1931	1932	1933	1934	1935	1936
Wire cloth	9,000	9,200	4,900	4,200	5,000	4,600	5,600	6,500
Ammunition	6,900	5,100	5,000	3,900	10,500	13,500	13,700	11,900
Castings, n.e.s. (a)	79,500	55,400	36,000	27,000	36,000	36,000	36,000	39,000
Clocks and watches	4,300	2,600	2,000	1,500	2,800	2,200	2,400	3,400
Coinage	1,200	850	100	100	100	900	1,500	2,000
Copper-bearing steel	2,600	1,900	1,200	800	1,500	2,100	2,300	3,900
Fire fighting apparatus	2,400	1,700	1,300	1,000	1,100	1,000	1,200	1,300
Radiators, heating	2,100	3,000	1,700	1,000	2,400	1,000	1,100	2,000
Radio receiving sets	15,500	13,000	10,000	7,000	11,500	12,500	16,000	24,000
Railway equipment (b)	9,600	8,600	1,800	700	800	2,100	1,800	4,000
Refrigerators (d)	17,200	15,000	13,000	9,000	11,400	15,700	15,400	15,000
Shipbuilding (d)	2,400	5,000	3,200	2,100	1,800	3,200	1,100	5,000
Washing machines (d)	4,500	1,200	1,600	1,500	1,000	1,400	1,300	1,500
Water heaters, household	2,300	1,800	1,400	1,000	1,500	1,500*	1,500*	1,500*
Air conditioning (c) (d)	....	....	....	....	....	3,800	4,600	6,400
Miscellaneous	70,000	57,000	40,000	27,300	40,000	42,000	46,000	59,000

(a) Bearings, bushings, lubricators, valves and fittings. (b) Includes air-conditioning beginning with 1933. (c) Other than railway. (d) Exclusive of electrical equipment. * Estimated figure.

BRIDGEPORT'S PHONO-ELECTRIC ALLOYS USED ON NEW OAKLAND—SAN FRANCISCO BRIDGE

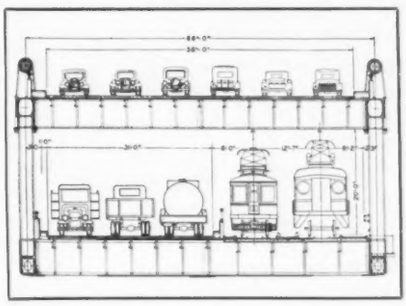
1200 Volt Overhead Catenary System Supplies Power

Traffic is flowing between San Francisco and Oakland on the world's greatest overwater roadway, which was opened to the public on May 27th. The world's first twin suspension bridge, largest bore tunnel, and third largest cantilever bridge are among the unusual features of this striking engineering achievement, which was directed by Charles H. Purcell, Chief Engineer and Chief Engineer California State Highway Commission; C. E. Andrew, Bridge Engineer; and Glenn B. Woodruff, Engineer of Design.



Bridgeport's 4/0 grooved Phono-Electric Bronze contact wire and seven and nineteen strand messenger cable were used in the transit electrification.

Electric trains will operate on a 75-second headway over the lower deck of the two-level roadway, which will also accommodate three lanes of truck traffic. The upper deck has space for six lanes of automobiles. In 1938, two-car articulated units will be placed in service, each seating 126 passengers and developing 440 horse-power. The Southern Pacific Company and Sacramento Northern trains will continue to use present equipment.



Cross-section of bridge shows double-deck construction, providing for six lanes of automobile traffic, three-lane truck roadway, and two-track rapid transit system.

Phono-Electric Picked for Overhead Construction

Bridgeport's 4/0 grooved Phono-Electric Bronze contact wire and seven and nineteen strand messenger cable were selected to meet the demands which will be placed on the 1,200 volt overhead catenary system by the heavy transit volume expected. Because of their high tensile strength, electrical conductivity, and resistance to corrosion, Phono-Electric Alloys have become the standard for electric railway and trolley bus installations. These alloys can be produced with a life factor three times that of hard-drawn copper, while retaining up to 85% of the conductivity of pure copper. Maintenance costs can be sharply reduced while power losses in the line are held to a low value.

Duronze Alloys, possessing the same corrosion-resistant qualities as Phono-Electric

(Continued on following page, column 2)

COPPER ALLOY BULLETIN

NEW DEVELOPMENTS

All items in this column are from sources believed to be reliable. Further information on any of them may be obtained by writing the Bridgeport Brass Company.

Small size cleaners, for condenser and heat exchanger tubes, are available in diameters from 15/32 to 17/16 of an inch and are reported suitable for straight or curved tubes. The cleaners operate on compressed air up to 100 pounds; consume 10-30 cu. ft. per minute. They may also be operated by steam.

New in service tools is a chain wrench said to be especially applicable for turning the square top off a brass valve; it works on both halves of a pipe union and also the tightening nut. It is also suitable for work in close quarters on pipe coils. Capacity is from diameters of ½ to 4½ inches.

For removing weld spatter and excess metal in arc welding, a new portable pneumatic scaling tool is offered. It removes flash and can be used in cleaning the surface of successive welds where several layers of weld metal are required.

A wire coil truck is especially designed for moving quantities of wire coil. Its end plate is only 1¾ inches from the floor, permitting operator to roll coils on platform from the rear. Corrugations on the platform hold the coils in place.

A precision flash welder, for use in welding drills, reamers, and similar tools, is designed to insure accuracy and prevent deflection. Back-up stops are mounted directly on top of the frame. Work stops and tie rods are on a common center with the center of welding pressure.

Coating of metallic surfaces by a newly patented process makes the surfaces non-wettable by oil. The surface is first cleaned by electrolytic treatment or by immersion in sodium hydroxide solution or carbon tetrachloride. A thin film of ferric stearate is then applied, either in molten form or as a solution in a volatile solvent. The process is said to prevent creeping of oil on lubricated parts or into electrical contact points.

Cable end seal for terminating and sealing 600-volt cables consists of a copper terminal lug having a gasketed flange, a plastic insulator, sealing bushings, and brass packing nut. Seal is made in two sizes, for 250,000 and 500,000 circular mill cable.

Coppering of mirrors is reported to be commercially practicable with a new process. Metallic copper is deposited out of a copper chloride solution by a suitable reducing agent.

A new comparator gage uses a fine-adjusting sleeve for rapid movement of the dial hand to final setting. Gaging head is raised and lowered by a handwheel, and can be securely locked in place. The entire head can be swiveled if it is necessary to gage from surfaces other than the anvil contained in the unit.

OAKLAND BRIDGE OPENS

(Continued from preceding page, column 3)

Bronze, are widely used for auxiliary poleline and equipment hardware in overhead electrification. High resistance to season cracking is an important factor in preventing hardware failures.

The experience of Bridgeport engineers in the application of Phono-Electric Bronze and Duronze Alloys to electric railway and trolley systems is readily available to engineers planning new electrifications or replacements.

LETTERS FROM OUR READERS

As publishers of the COPPER ALLOY BULLETIN the Bridgeport Brass Company invites correspondence from its readers. Suggestions and criticisms will be welcome. Questions from readers on the subject of copper and its alloys will be given careful attention and if there is sufficient interest the COPPER ALLOY BULLETIN will publish a regular question box in an effort to further the scope of its service.

SILICON BRONZES IDEAL FOR WELDED TANK FABRICATION

Silicon bronzes are rapidly gaining in favor for the fabrication of range boilers, hot and cold water storage tanks, and automatic heaters. High resistance to corrosion and ease of welding, contributing to simplicity of manufacture, are important factors in the increasing demand for silicon bronzes.

Silicon bronze welding rods are especially suited for the fabricating process, because of their low thermal conductivity, good hot ductility, and the formation of an adherent flux film which protects the molten weld metal.

In fabricating tanks, the bodies of the tanks are cut from sheet bronze and rolled into cylinders. The heads are stamped out from circles of the metal, and all joints are welded by either gas or arc.

Bridgeport's Duronze II, supplied in hot rolled sheets having a tensile strength of 55,000 pounds per square inch and upward, is exceptionally well adapted for tank fabrication. Its resistance to corrosion is better than that of copper. When used in tanks, it does not require reinforcement inside the tank.

Welding of Duronze II is best accomplished with Bridgeport's No. 1232 Silicon Bronze welding rod, which is of the same composition as Duronze II. The welding process, therefore, does not introduce a different alloy. Duronze II tanks, welded with No. 1232 Silicon Bronze welding rod, economically solve the problem of rusting and corrosion.

BRASS TERMINOLOGY

This is the second of a series on the nomenclature peculiar to the industry specializing in the making of brass, bronze and copper alloys. Another article will appear in next month's issue.

Standard Brass Alloys

Commercial Bronze refers to an alloy containing 90% of copper and 10% of zinc. The term commercial bronze is also used to include other alloys containing about 90% of copper, together with a small percentage of tin, but the term, when used without qualification or modification, designates the 90%-10% alloy. Among its uses are applications where its rich "bronze" color is desired or, because of its comparatively high melting point, where a subsequent baked enamel finish is wanted.

Rich Low Brass designates an alloy of 85% of copper and 15% of zinc. When used in the form of pipe, this same alloy is commonly designated as Red Brass Pipe.

Low Brass refers to an alloy of 80% of copper with 20% of zinc. When polished, low brass has a brilliant golden color. It is widely used in the jewelry trade and in other places where color is important. It also enjoys considerable demand for certain fabricating operations because of its relatively high ductility.

Common High Brass is an alloy containing 66% of copper and 34% of zinc. The alloy is not necessarily low in impurities. The term differentiates between this alloy and higher grades of brass containing about two parts of copper to one part of zinc.

PRODUCTS OF THE BRIDGEPORT BRASS COMPANY

Executive Offices: BRIDGEPORT, CONN.—Branch Offices and Warehouses in Principal Cities

SHEETS, ROLLS, STRIPS—*Brass, bronze, copper, Duronze,** for stamping, deep drawing, forming and spinning.

CONDENSER, HEAT EXCHANGER, SUGAR TUBES—For steam surface condensers, heat exchangers; oil refineries, and process industries.

PHONO-ELECTRIC* ALLOYS—High-strength bronze trolley, messenger wire and cable.

WELDING ROD—For repairing cast iron and steel, fabricating silicon bronze tanks.

LEDRITE* ROD—For making automatic screw machine products.

BRASS "Bridgeport" CO. *Established 1865*

COPPER WATER TUBE AND FITTINGS—For plumbing, heating, underground piping.

DURONZE ALLOYS—High-strength silicon bronzes for corrosion-resistant connectors, marine hardware; *hot rolled sheets* for tanks, boilers, heaters, flues, ducts, flashings.

BRASS, BRONZE, DURONZE WIRE—For cap and machine screws, wood screws, rivets, bolts, nuts.

FABRICATING SERVICE DEPT.—Engineering staff, special equipment for making parts or complete items.

BRASS AND COPPER PIPE—"Plumrite"* for plumbing, underground and industrial services.

*Trade-name.

BRIDGEPORT BRASS

Vienna Stores Steam for Momentary Peaks

[*Continued from page* 43]

San Francisco power plants and elsewhere, an enlarged steam drum was purchased for the ventilating steam to the spinning stand-by turbine and to the necessary steam-driven auxiliaries. The water volume in this big drum and in other parts of the boiler is so great that it serves as a high-pressure accumulator. In case of outage, this water reserve can furnish sufficient steam to the turbine at decreasing pressures to carry full load for several minutes or approximately for double the time required to get the oil-fired burners in operation and developing full steam capacity.

•

Will Present New Products

Two new home appliances will shortly be introduced by the Michigan Bumper Corporation, Detroit, Mich., according to James H. Frazier, in charge of the corporation's new specialty division. The corporation recently introduced "WesCrel" light, a multiple-use floor light.

•

R. L. Swats Forms Company

Announcement has been made of the establishment of R. L. Swats and Associates, with headquarters in the Field Building, Chicago. Mr. Swats, as vice-president of LaSalle Extension University and executive director of its corporation service division cooperated with the General Electric Company and the Edison General Electric Appliance Company of Chicago in pioneering the development of sales training methods now used in home appliance, specialty appliance and lighting fields.

•

Carrier Forms Home Unit

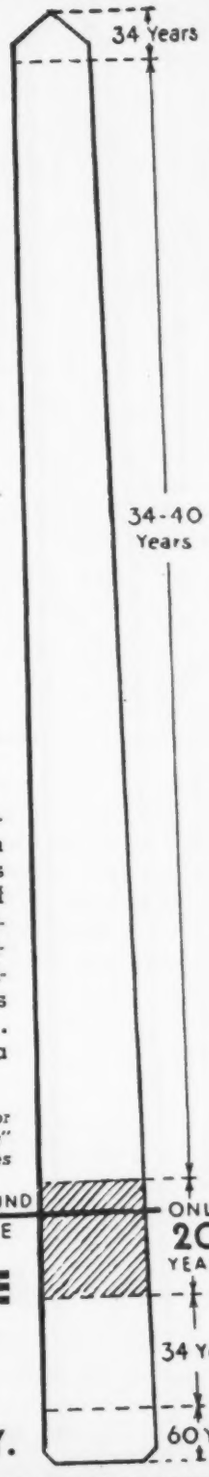
Announcement has been made by L. R. Boulware, vice-president and general manager of Carrier Corporation, Newark, N. J., of the formation of a new separate department to handle residential air conditioning. Heading the new department is George T. Long, who has had a wide background of experience in home heating with other manufacturers and three years of residential air conditioning experience in the field with Carrier.

OSMOSE GROUNDLINE TREATMENT • FOR STANDING POLES • OSMO
FOR STANDING POLES • OSMOSE GROUNDLINE TREATMENT • FOR

How Much Money Is GROUNDLINE DECAY

In Your Standing Poles COSTING YOU?

A national survey shows that decay destroys the standing pole AT THE GROUNDLINE to the extent of 41% of its service life! While the dependable life of the pole above and below the groundline is 34-40 years . . . AT THE GROUNDLINE it is 20 years or less. If groundline decay in standing poles and piling is checked . . . and further decay prevented . . . the service-life of the groundline zone will equal that of the rest of the pole.



Prolong the Service-Life of Standing Poles and Piling with the OSMOSE Groundline Treatment

This process offers a means of securing deep and effective penetration of universally accepted preservatives into the wood through the medium of osmosis. The OSMOSE GROUNDLINE TREATMENT preserves standing poles and piling at the groundline. It may be applied to your poles and piling by your own forces . . . without special equipment . . . at a nominal cost.

A booklet describing "The Osmose Process for the Preservation of Standing Poles and Piling" will be sent upon request. Protect your poles in

THIS DANGER ZONE →

OSMOSE PROCESS for WOOD PRESERVATION — OSMOSE CORPORATION OF AMERICA BUFFALO, N.Y.

OSMOSE CORPORATION OF AMERICA

BUFFALO, N. Y.

OSMOSE GROUNDLINE TREATMENT • FOR STANDING POLES • OSMO
FOR STANDING POLES • OSMOSE GROUNDLINE TREATMENT • FOR

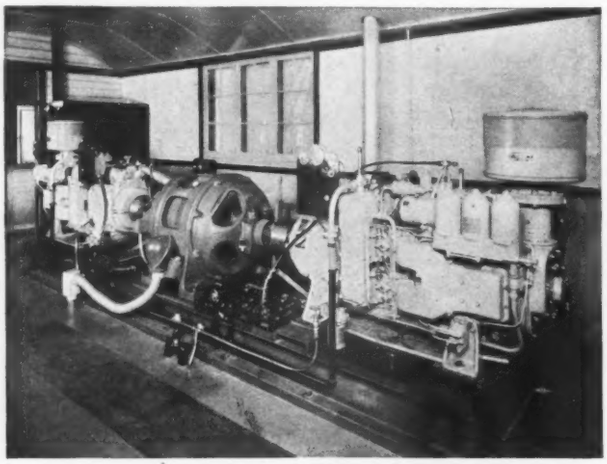
Establishing New Records

Report of STERLING crankless Diesel engines

built under
"MICHELL CRANKLESS ENGINE"
patents

after 7 months continuous service:

"At all loads, from no load to full load, the exhaust is absolutely clean, with no sign of either black or gray smoke, this showing the combustion is perfect and that lubricating oil is not passing by the pistons.



Installation of 2 STERLING crankless Diesel engines in American Ice Company plant, Sacramento, California.

"The balance of load between the various cylinders, as shown by exhaust temperature pyrometer—regardless of whether both engines are driving the generator or only one, is especially good. With one engine running the exhaust temperatures taken showed 410°, 410°, 412°, 408°, for the four cylinders, an absolutely equal balance of power between the cylinders."

Investigate the advantages Sterling offers before you buy a Diesel

Sterling
THE ENGINE OF REFINEMENT

Catalog on request. Please state your requirements.

STERLING ENGINE COMPANY

Home Office and Plant
1270 Niagara Street
Buffalo, New York

Dept. C-2

Branch Office
900 Chrysler Bldg.
New York, N. Y.

Many Control Steps With Few Contactors

[*Continued from page* 47]

large steps of resistance from notch to notch, and that these steps rapidly decrease in size for satisfactorily smooth acceleration. As the effective resistance is reduced and the motor current builds up a value producing the maximum torque the reduction in succeeding steps of resistance is much less, due to the change in steepness of the motor curve. During this period of the acceleration slightly decreasing or even equal steps of resistance are desirable. This enables the "Vernier" resistor section to fulfill satisfactorily these two requirements, namely:

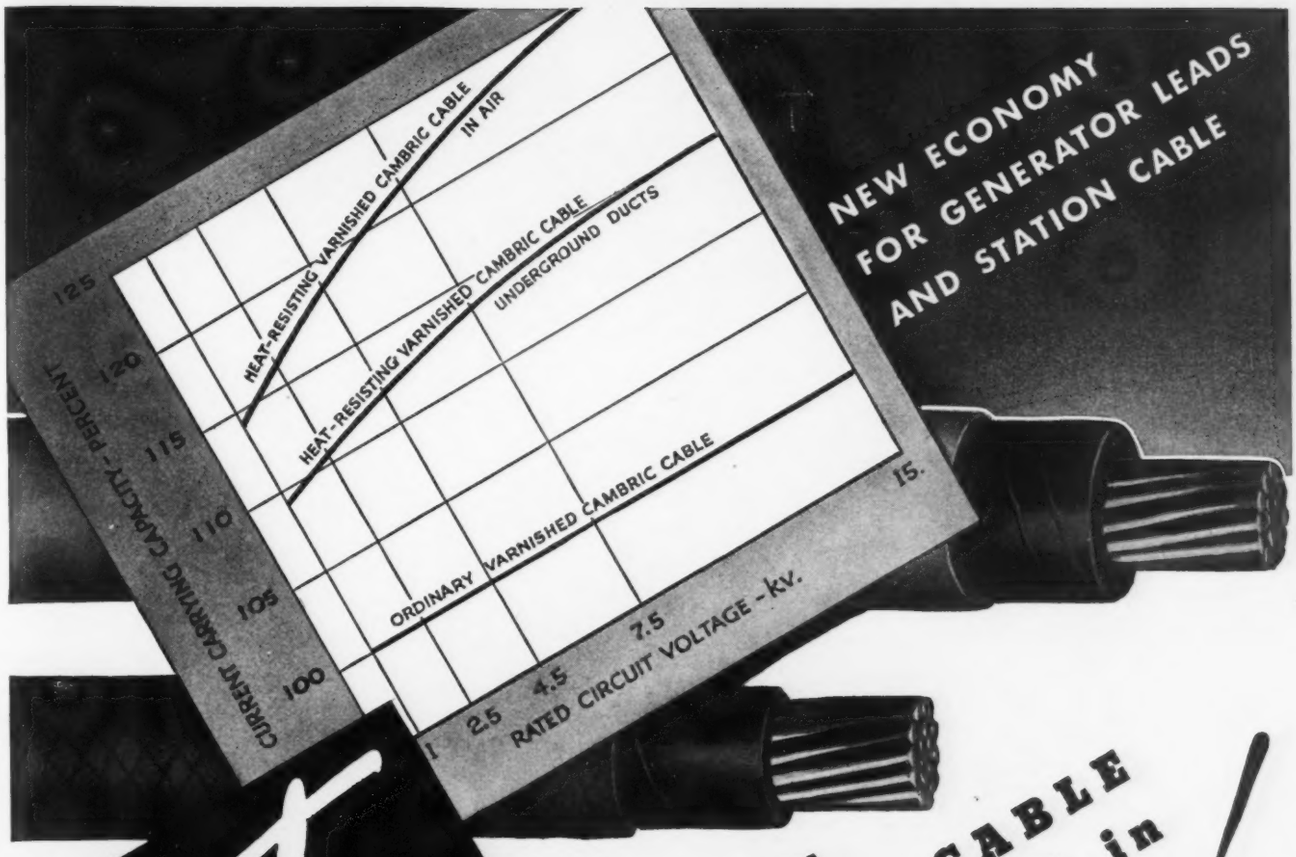
(a) In its first notching progression each succeeding step is considerably reduced for proper build-up to the maximum accelerating rate.

(b) In the subsequent notching of the "Vernier" resistor when paralleled with other sections, these widely varying steps produce relatively even steps such as are desirable for that phase of acceleration.

The "Vernier" method of resistor notching differs from conventional methods in that in the past it has been standard practice to use either straight progressive notching, producing one notch per contact device, or several multiple paths in re-using the contact devices, necessitating differing contact sequence on their subsequent operations. The "Vernier" system maintains the same contact sequence in all progressions, thereby eliminating complicated interlocking or the necessity of sequence drums for setting up the various combinations of circuits for controlling the differing contactor sequences.

The "Vernier" control scheme is used on the latest single motor superperformance trolley coaches. It has also been applied to older street cars whose motors have been "speeded up" to keep pace with modern traffic conditions. This is accomplished by changing drums in the old control, thereby increasing the number of notches from eight to 22. This also involves changes in resistors. Increasing the number of notches in this manner has been found to have the following outstanding advantages.

1. Smoothness of acceleration.
2. Reduction in current swings and torque change from notch to notch.
3. Fine speed control.



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the NEW GENERAL CABLE DEVELOPMENT in Efficiency!

Advantages OF HEAT-RESISTING V. C. CABLE OVER ORDINARY V. C. CABLE

1. More Current for any given conductor size.
2. Smaller conductor for same current.
3. Lower cost per kv-a.
4. Longer life at high ambient temperatures.
5. Considerably greater current carrying capacity at high ambient temperatures.
6. Increased current, as charted above, is independent of conductor size or number of cables in duct bank.

SPECIFY GENERAL CABLE HEAT RESISTING V. C. CABLE

GENERAL CABLE

GENERAL CABLE CORPORATION

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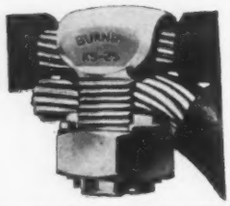
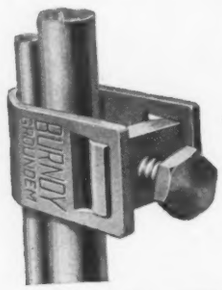
BURNDY CONNECTORS

all along the line!



SERVIT—the service connector with "forged-in" strength; made in many types



GROUNDEM—the ground clamp that slips over the top or around the rod

CLIP—for "dead-ending"; made of strong, corrosion-resistant Everdur

HOTTAP—for taking distribution transformer taps from primary lines

BUTTIN—for joining wires or cables on end; compact, low in cost, reusable

SPLICIT—the automatic line splice with the grip that holds

BURNDY

ENGINEERING (B) COMPANY, Inc.

459 E. 133d St., NEW YORK, N. Y.

System Factor Terms Too Often Distorted

[*Continued from page* 50]

When related to a system the definition could be extended to include not only generating capacity, but also purchase capacity. In judging the reliability or utilization of facilities of a system, the purchase capacity may be considered additional available generating equipment.

Utilization factor

Utilization factor is the ratio of the peak load of a power plant or a system to the rated capacity of the power plant or system.

Next in importance to the plant factor, the utilization factor presents a picture of the utilization of facilities at peak time and the amount of available reserve and excess capacity. It is the ratio of the peak load of a power house or a system to the rated capacity of the power house or system. The peak, of course, must be qualified in each case as to duration. Here, too, the purchase capacity can be included under "capacity," in addition to the generating capacity.

Demand factor

Demand factor is the ratio of the maximum demand of a system to the total connected load of the system.

Demand factor presents a picture of utilization of connected load. It is a shorthand expression of the degree of use of customers' connected load at the time of the system peak. This factor is used mainly in system design.

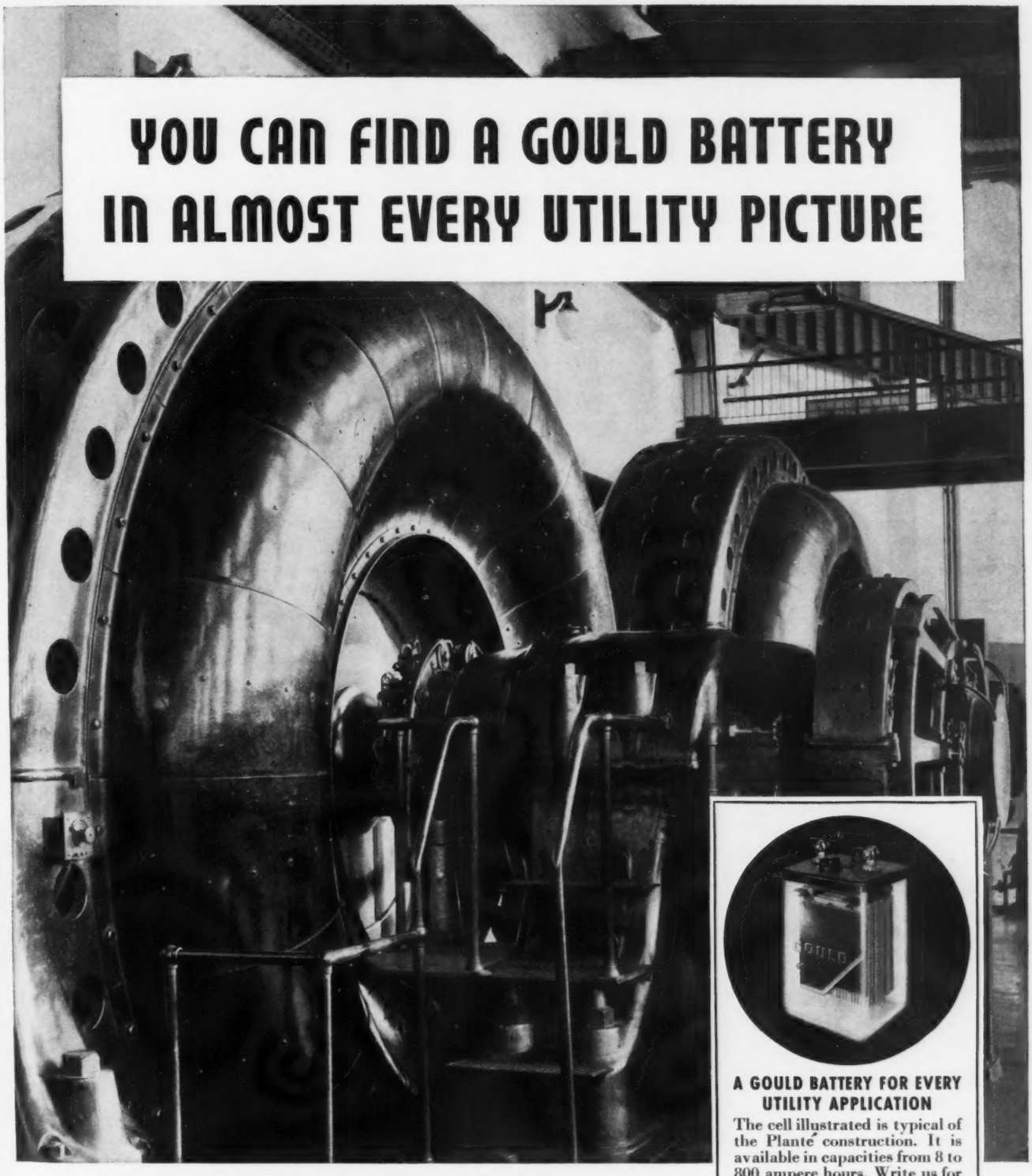
Diversity and coincidence factors

Diversity factor is the ratio of the sum of all non-coincident maximum demands of the various loads to the system peak.

Never less than unity, a higher diversity factor indicates that the peaks of the various loads are better distributed over the system load curve, which is a favorable condition for the system. A high diversity factor calls for less system capacity for the same customer peaks than a lower diversity factor. In a number of theories of allocation of fixed charges that use the non-coincident demands instead of the peak responsibility as a basis, the diversity factor is introduced for the purpose of establishing a theoretical peak responsibility even for customers whose load curves have no peak responsibility at all.

This is a very useful factor indeed, but it must be remembered that simi-

YOU CAN FIND A GOULD BATTERY IN ALMOST EVERY UTILITY PICTURE



A GOULD BATTERY FOR EVERY UTILITY APPLICATION

The cell illustrated is typical of the Plante construction. It is available in capacities from 8 to 800 ampere hours. Write us for free illustrated manual giving complete information on all types of Gould Batteries.

Gould serves 69 major utilities

You can't see the battery in this picture, but it's there just the same. Guarding the current produced by these giant generators is a rugged Gould battery.

It is one of many serving 69 major utilities and hundreds of smaller plants all over the country. These batteries furnish the quick energy necessary for instant operation of circuit breakers, relays, indicators and emergency lighting equipment.

Gould offers three types of lead acid storage battery construction for utility applications. They are the Plante, the Armored Kathanode, and the Dreadnaught. Each has its own characteristic, and each is in a different price class. But all of them have one thing in common. They represent the best battery investment you can make at any price.

GOULD BATTERIES *for every purpose*

GOULD STORAGE BATTERY CORPORATION, DEPEW, NEW YORK

MICABOND

the only insulation for some . . . the best insulation for many purposes

Micabond combines the good qualities of raw mica with adaptability. It is mica in its most usable form — insulation that should be specified wherever maximum dielectric strength is needed in equipment subject to high operating temperatures.

Let us help you select Micabond in correct grade, form and strength for your requirements. Perhaps it might be economical to have us supply your fabricated parts, ready for assembly, a service some Micabond users find most advantageous. Ask for details.

CONTINENTAL-DIAMOND FIBRE COMPANY
NEWARK, DELAWARE
Represented in Canada by
DIAMOND STATE FIBRE CO. of Canada, Ltd., Toronto

MOLDING PLATE **HEATER PLATE**
SEGMENT PLATE **FLEXIBLE SHEETS**
TAPE-TUBING

FABRICATED PARTS SUCH AS "V" RINGS, SEGMENTS AND WASHERS

lar to the load factor, it has no relation to capacity and hence no direct relation to fixed charges. The diversity factor can also be established from load curves without knowing the scale to which they are drawn; it is only necessary to know the ratios of the scales of the various load curves to one another.

Coincidence factor is the reciprocal of the diversity factor.

The coincidence factor is never greater than unity. In mathematical treatment the reciprocal frequently simplifies the treatment. In fact, the coincidence factor seems to be more common in mathematical treatment than the diversity factor.

Operation and output factors

Operation factor is the ratio of the duration of actual service of a machine, a power plant or a system to the total duration of a period considered.

Since most engineers prefer to state directly the number of hours a machine or plant was operated in a year, this factor is seldom used except in mathematical treatment of cost allocations where it makes for convenience.

Output factor is the ratio of the actual output of a machine during a certain period to the output which could have been obtained during the actually operating hours in that period by operating the machine at rated capacity.

The output factor has the same value as the capacity factor if there is no non-operating interval in the period considered. Generally, therefore, the output factor is greater than the capacity factor. Load factor has more significance when used in conjunction with operation factor than when used alone.

[The author of the above is Electrical Engineer of the Federal Power Commission.]

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Stone & Webster Contract

Stone & Webster Engineering Corporation has received a contract from the Massachusetts Institute of Technology covering engineering services and the management of the construction of a new building at Cambridge, Mass., to house the Architectural School.

1937 EDITION

Detailed Data on The Light and Power Industry *at Your Finger Tips*

McGRAW CENTRAL STATION DIRECTORY

CONTENTS

Names and addresses of independently owned electric light and power companies in the United States, Canada and United States Possessions.

Names and addresses of municipally owned electric light and power systems in the United States, Canada and United States Possessions.

Names and addresses of affiliated, holding, controlling or managing companies with complete lists of properties controlled or managed by each.

Names and addresses of principal officials of holding and managing companies.

Names and addresses of officials and chief operating men for all operating companies including:

Presidents
Vice Presidents
General Managers
Chief Engineers
Electrical Engineers
Mechanical Engineers
General Superintendents
Plant Superintendents
Plant Engineers
Superintendents of Distribution
Superintendents of Transmission
Commercial or New Business Managers
Merchandising Managers
Purchasing Agents
Division or District Managers
Division or District Superintendents
Division Merchandising Managers

For each operating company the following information is presented:

Generator Capacity in kva. or kw.
Kind of Prime Mover and Capacity in hp.
Amount of power purchased in kw.-hrs.
Type of current distributed, number of wires, phase and cycles.
Number of meters served.
Location of power plants.
Location of districts or divisions.
Complete list of towns (having a population of 500 and over) served.

National and State Public Utility Commissions with addresses, names of commissioners and principal assistants.

A complete alphabetical index of companies and municipal systems giving location by city and state.

All the information you need to intelligently contact this field

READY NOW

The McGraw Central Station Directory gives complete information on the organized agencies which furnish electric light and power service to communities of 500 or greater population in the United States, Canada and United States Possessions.

It lists all operating and holding companies, arranged alphabetically according to cities and states, together with the names and titles of operating officials and other executives, names of the cities served by each company, capacity and location of plants, amount of power purchased, type of current distributed, number of meters served.

National and State Commissions are also listed, together with their commissioners and principal assistants.

More than 800 pages—handy size—4½" x 8½"—printed in clear readable type—bound in flexible covers that resist hardest usage — fully thumb-indexed by states. Price $25.00 per copy with 10% discount on orders for 5 copies or more.

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★ Highway Bodies serve the widest range of utility needs—they are designed with full consideration given to durability and appearance, as well as accessibility and convenience.

Highway Bodies are economically adaptable to today's requirements. They are furnished complete with Highway Winches, Derricks, and associated equipment to fully complete the line construction and maintenance truck.

Highway makes a complete line of bodies for Central Station line construction and service trucks. Highway Bodies are dependably and economically serving many utilities today.

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Municipal Plants

ROCK PORT, MO.—Local city officials are contemplating the purchase of the local electric distribution system of the Missouri Public Service Company. Citizens at a special election held last month by a vote of 461 to 194 approved the issuance of $90,000 in bonds to help finance the purchase or construction of an electric light and power plant and distribution system. The Engineering Service Company, Kansas City, Mo., has been retained to prepare plans and specifications for the project.

AUBURN, NEB.—Attorneys for the Western Public Service Company have gone into United States district court in an effort to halt condemnation proceedings against its property in Auburn and surrounding villages. Counsel for the utility company filed a petition for an injunction against the city and three district judges. The judges were appointed by the state supreme court to appraise the property. Citizens this spring approved a bond issue for purchase of the property. The power company alleged that the resolution adopted by the Auburn city council differs in form and substance from the proposal as it appeared on the ballot and that it was indefinite and ambiguous in that it did not say what portions of the lines were to be condemned. The company asked that the condemnation court be enjoined from taking testimony bearing on the value of the property on the grounds that it has no authority to sit in the case. Communities involved in the proceedings, besides Auburn are Johnson, Howe, Nemaha, Graf and Brownville.

DELPHOS, OHIO.—A $300,000 bond issue for a municipal electric plant was defeated 1,339 to 712 in a special election. The election was called in petitions circulated by the Ohio Power Company after city council passed an ordinance to construct the plant.

SANDUSKY, OHIO.—State Supreme Court has sent the Sandusky municipal light plant dispute back to the Erie County Common Pleas Court. After Sandusky voters had approved $1,400,000 bond issue for construction of a municipal light plant, the Ohio Public Service Company, as a taxpayer demanded that the city solicitor bring a suit to enjoin issuance of the bonds on the grounds that plans and specifications for the improvement were not on file when the city commission ordered the election. The Common Pleas Court sustained a demurrer to the action, holding the bond issue legal. The Court of Appeals reversed and remanded the case for new trial in the Common Pleas Court. The Supreme Court dismissed the city commission's appeal on the ground that no constitutional question had been raised.

PORTSMOUTH, VA. — Acceptance by city council of the proposal that the city enter into a ten-year contract with Virginia Electric & Power Company for electric service has met with a storm of protest. Dr. Vernon A. Brooks, former mayor, at a mass meeting urged the city to try to acquire funds to erect a municipal power plant from private sources if it could not obtain them from the Federal government. He suggested that a committee be appointed to poll the residents in an effort to determine whether they would support a municipal plant. City Manager Charles Harper defended the contract, stating that the city has no prospect of obtaining a Federal grant. Virginia Electric & Power Company's contract with the city calls for electric service for a ten-year period that because of reduced rates and savings in operations will result in a saving to the city of $20,000 a year. The project

SERVICE Entrance and Drop Cables made by the American Steel & Wire Company have been designed to reduce the cost of service change-overs involved in the installation of ranges and other appliances in homes, and to eliminate current diversion.

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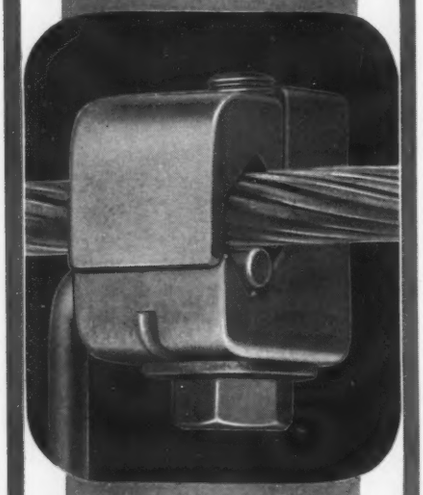

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includes electrification of the water works pumping station on Godwin Street at a cost of $25,000, which will be borne entirely by the company and will result in a saving of possibly $1,000 a year in operating charges at the station. If the city after 10 years does not renew the contract, it will pay only half the cost of the electrification work.

McFARLAND, WIS.—Circuit Judge A. C. Hoppmann has granted a dismissal motion in the action of the village, seeking to acquire the utility property of the Wisconsin Power & Light Company on the ground that the referendum question on which the acquisition proceeding was based had been improperly phrased.

•

Recent Rate Changes

ILLINOIS COMMERCE Commission has announced that estimated annual savings through rate reductions for the month of May amounted to $30,230. Of this sum electric rate cuts totaled $25,382, gas $3,663 and telephone $1,185.

PUBLIC SERVICE COMPANY OF COLORADO has reduced rates for electricity in the Boulder and Sterling areas. The cut will mean a saving of approximately $20,000 annually to consumers.

KENTUCKY-TENNESSEE LIGHT & POWER COMPANY's new rate schedule, providing for a saving of approximately $62,500 annually, has been approved by the Kentucky Public Service Commission. The new rates apply to residential customers only.

IOWA-NEBRASKA LIGHT & POWER COMPANY has reduced its electric rates in Humbolt, Neb., from $1,200 to $1,400 annually. City and utility officials reached an agreement on the reduction during a series of conferences. Because of its new water pumping and street lighting contract, the city will receive most of the benefits from the slash, Mayor Wedner stated.

ORANGE -and ROCKLAND ELECTRIC COMPANY has filed revised electric rates with the New York Public Service Commission which are estimated to save consumers $6,783 annually. The changes include the elimination of minimum charges based on floor areas and connected loads which are not permitted by law.

UTICA GAS & ELECTRIC COMPANY has filed rate revisions with the New York Public Service Commission which affect the rate for primary service in the company's territory. The effect on revenues and customers is not given because the operating characteristics of customers under off-peak and on-peak provisions are indeterminate.

UPPER VERDE UTILITIES COMPANY has been ordered by the Arizona Corporation Commission to reduce its electric rates for domestic users in Jerome and Clarkdale 14 per cent. This reduction is retroactive to apply to electricity used since May 1. The commercial rate was ordered cut 12½ per cent. Jerome and Clarkdale residents will save $10,000 a year by this reduction.

MARION-RESERVE POWER COMPANY has reduced commercial rates in Marion $17,000 annually. The new schedule is 6 cents a kilowatt-hour for the first 50 kw-hr., 5 cents each for the next 450 kw-hr., 4 cents for the next 500 and 3 cents over 1,000.

MOHAWK, N. Y., has filed revised rate schedules with the Public Service Commission which are estimated to save electric customers of the municipal plant about $2,688 a year. The revised rates include reductions in charges for both residential and general electric service and of the total

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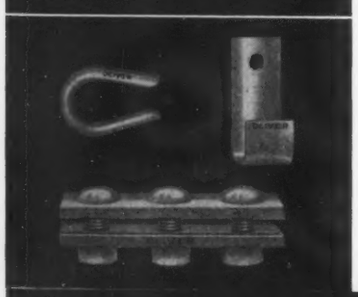

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saving, about $2,116 will be saved by residential customers annually. No consumer will be increased by the change in rates.

PEOPLE'S GAS & ELECTRIC COMPANY of Oswego, N. Y., and the Fulton Light, Heat & Power Company have filed revised electric rates which reduce the portions of energy used in excess of 200 kw-hr. per month from 3 cents to 1½ cents per kilowatt-hour for residential customers with an electric water heater. The change is effective in the territory of these companies which includes the towns of Minetto, New Haven, Oswego, Scriba, Granby and Volney in Oswego County. The change is not applicable in the cities of Oswego and Fulton because gas service is available there.

CAZENOVIA ELECTRIC COMPANY has filed revised electric rates with the New York Public Service Commission which are estimated to save consumers $3,491 annually. The new rates eliminate the "counted room" features of the present rates as is required by law and of the $3,491 saving to customers, the residential consumers will save $3,190 a year and the balance of the reduction will benefit seasonal customers.

SHELBY, O., has reduced electric light rates approximately 19 per cent and the new rates have been approved by city council. The reduction was made possible through an increase in the plant's surplus funds.

COMMUNITY PUBLIC SERVICE COMPANY, Winchester, Ky., has announced a reduction in electric rates for thirteen communities which will effect an annual saving of approximately $8,600 for consumers.

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Electric Manufacturers Get Jacksonville Contracts

The City Commission, Jacksonville, Fla., has awarded contract to the General Electric Company for a new turbo-generator unit for municipal electric plant, including exciter and auxiliary equipment, at price of $663,222. An award for condenser equipment has been made to the Allis-Chalmers Manufacuring Company, at price of $182,114. The city has arranged a total fund of $1,350,000 for expansion and improvements in the station, and will soon place orders for additional equipment, including boilers, pumps, switchboard and complete accessories.

•

Use Postcard Advertising

As a tie-in with national newspaper advertising, Kelvinator room cooler dealers are using a series of six direct mail cartoon postcards that are attracting wide industry attention.

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Designers Open New Offices

Designers for Industry, Inc., of Cleveland, Ohio, industrial designers and product stylists, have established New York quarters in International Building, Rockefeller Center, according to President C. H. Oppenheimer.

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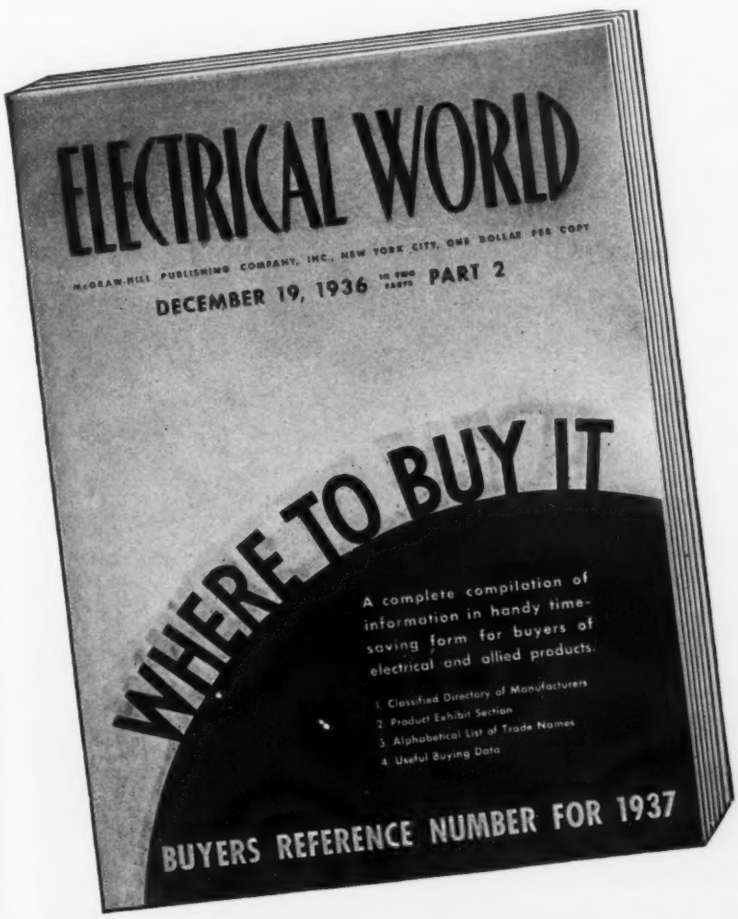
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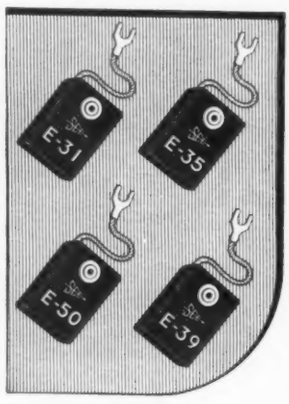

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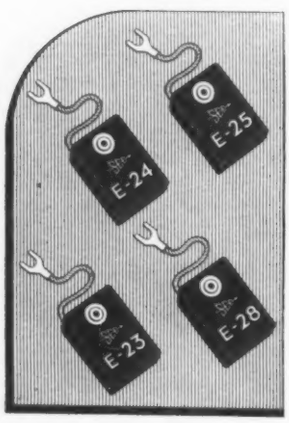

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Sales Opportunities

SAN DIEGO, CALIF.—San Diego Consolidated Gas & Electric Company is having plans completed for new indoor power substation at Front and Robinson streets, reinforced-concrete type. Frank L Hope, Jr., San Diego Trust & Savings Building, San Diego, is architect.

MEMPHIS, TENN.—Light and Water Department receives bids until July 15 for transformers, switchgear, regulators and other equipment for South Gate power substation, which will be connected with TVA lines; also for power circuits at substation. Entire project is estimated to cost $270,000. N. W. Wade, Goodwyn Institute Building, is secretary of department.

TRENTON, N. J.—Ternstedt Manufacturing Company, 6307 West Fort Avenue, Detroit, Mich., a division of General Motors Corporation, Detroit, specializing in manufacture of automobile hardware, plans installation of motors and controls, conveyors, regulators, transformers and accessories, electric hoists and other equipment in new plant on Scotch Road, Ewing Township, near Trenton, where tract of 97 acres of land has been acquired. It will comprise several one-story units, totaling about 900,000 square feet of floor space. A power house will be built. Cost over $7,500,000. Work is scheduled to begin this summer.

BELLEVUE, IOWA—Receives bids until July 15 for equipment for municipal electric power plant, including diesel engine-generator unit and accessories, switchboard panels, instruments, etc. Young & Stanley, Inc., Muscatine, Iowa, is consulting engineer.

CHESAPEAKE, MO. — Lawrence County Water, Light & Cold Storage Company, Joplin, Mo., plans new 11,000-volt transmission line from Mount Vernon power substation to point near Chesapeake, where power substation will be located, and a 6,900-volt transmission line from such point to Chesapeake, where service will be furnished in future. A distributing system will be installed at Chesapeake. Application has been made for permission.

ALBERT, OKLA.—Caddo County Electric Cooperative, Inc., Albert, William Bryan, president, has plans nearing completion and will take bids soon for primary and secondary lines for rural electrification system in parts of Caddo, Comanche and Grady Counties, totaling about 170 miles, with outdoor power substations and service facilities. Cost about $180,000. Financing has been arranged through Federal aid. E. T. Archer & Company, New England Building, Kansas City, Mo., are consulting engineers.

LAKE ARTHUR, N. M. — Central Valley Rural Cooperative Electric Company, Lake Arthur, has plans maturing for primary and secondary lines for rural electrification in parts of Eddy and Chaves Counties, totaling about 84 miles, with outdoor power substations and service facilities, estimated to cost close to $104,000. A steam-electric generating station will be built for power supply, to cost about $60,000. Fund of $164,000 is being arranged through Federal aid.

RIVERVIEW, MICH.—Firestone Steel Products Company, Akron, Ohio, a subsidiary of Firestone Tire & Rubber Company, same address, plans installation of motors and controls, conveyors, electric hoists, regulators, transformers and accessories, and other equipment in new one-story mill, 300 x 700 feet, at Riverview, where tract of 80 acres of land has been acquired. It will be used for manufacture of automobile tire rims and kindred products. Cost over $600,000. Russell Engineering Corporation, 607 Shelby

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CONCENTRIC CABLE CLAMPS

Install Service Cable more conveniently.

Save a length of cable on each installation.

Reliable Concentric Cable Clamps are high in strength, neat and non-corrosive. They do not injure the cable and they are reasonably priced.

● Service cables can be more conveniently installed and then cut to accurate length through the use of Reliable Concentric Cable Clamps and installing tools. This eliminates the waste of a few feet of cable that occurs in normal installation practice in which the cable is cut before being installed.

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Street, Detroit, Mich., is consulting engineer.

MADISON, WIS.—Madison Gas & Electric Company has awarded building contract to J. H. Findorff & Son, 601 West Wilson Street, Madison, for proposed addition to local steam-electric generating plant. Entire project will cost about $1,500,000, with turbo-generator unit and accessory equipment. Mead, Ward & Hunt, State Journal Building, Madison, are engineers.

KETTLE RIVER, MINN.—Carlton County Co-operative Power Association, Kettle River, will take bids at once, to close early in July, for primary and secondary lines for rural electrification in parts of Carlton, Aitkin and Pine Counties, totaling close to 100,000 miles, with power substations and service facilities. Fund of $105,000 has been secured through Federal aid. Wendell W. Cutcliffe, Federated Electric Co-operative, 739 Johnson Street, N. E., Minneapolis, Minn., is consulting engineer.

BELLINGHAM, WASH.—Puget Sound Pulp & Timber Company, Bellingham, plans installation of motors and controls, conveyors, electric hoists, regulators and other equipment in new addition to local mill, for production of rayon pulp. Expansion will comprise several one and multi-story units. Cost over $1,500,000.

OWENTON, KY.—Owen County Rural Electric Co-operative Corporation, care of Ray W. Chanaberry, Inc., Realty Building, Louisville, Ky., consulting engineer, will receive bids until July 6 for primary and secondary lines for rural electrification in parts of Owen and Grant Counties, totaling 117 miles, including poles, cross-arms, wire and cable, line fittings and hardware, transformers, etc. Cost close to $120,000.

LONG BEACH, CALIF.—Los Alamitos Sugar Company, Montana Ranch, Long Beach, plans installation of motors and controls, conveyors, regulators, transformers and accessories, electric hoists and other equipment in proposed new beet sugar mill in Imperial Valley district, where site is being selected. A power house will be built. Entire project will cost close to $1,000,000.

OTTUMWA, IOWA.—Iowa Southern Utilities Company, Centerville, Iowa, has awarded contract to Federal Engineering Company, Central Office Building, Davenport, Iowa, for extensions and improvements in steam-electric generating station at Ottumwa. Additional equipment will be installed. Entire project will cost close to $150,000.

PLAQUEMINE, LA.—Receives bids until July 13 for equipment for municipal electric power plant, including diesel engine-generator unit and auxiliary equipment, pumping machinery and accessories, switchboard, crane and miscellaneous equipment.

PATRICK, S. C.—Carolina Power & Light Company, Raleigh, N. C., plans primary and secondary lines for rural electrification in vicinity of Patrick, Chesterfield County. Application has been made for permission.

●

North American Must Pay Tax

The Board of Tax Appeals has ruled that the North American Company of New York City was $390,282 deficient in income taxes. The Bureau of Internal revenue had assessed the utilities holding company for $967,973. The company contended that the bureau erred in disallowing deductions for losses, credits for taxes paid, and depreciation, expenses and bad debts.

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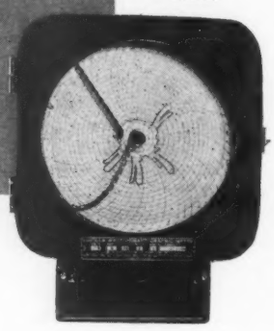

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LINCOLN METER COMPANY
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New Loan Contracts Executed by REA

Among the recent allotments announced by Rural Electrification Administrator John M. Carmody are the following:

ALABAMA—First allotment of $105,000 has been made to an organization to be formed in Pike County. When brought to its full size the system will serve 2,855 customers over 796 miles of line in Pike, Coffee, Covington and Crenshaw counties.

MISSISSIPPI—$205,000, Southwest Mississippi Electric Power Association, 202 miles of line, 606 customers.

OREGON—$129,000, Umatilla-Morrow Power Cooperative, Hermiston, 120 miles, 492 customers.

WEST VIRGINIA—$211,000, Harrison County Rural Electrification Association, Clarksburg, W. Va., 196 miles, 743 customers in Harrison and adjacent counties.

IOWA—$75,000, construction of transmission and distribution lines in Franklin County, has been transferred to the Central Electric Federated Cooperative Association of Pocahontas. This allotment was made for line construction through an error. It was intended for use in building a generating plant in Pocahontas County. It is contemplated that funds will be made available to complete the Franklin County lines from appropriations for loans during the coming fiscal year. It is imperative, however, that additional funds be made available immediately for the generating plant, since it will serve four distribution co-operatives whose systems are about to enter construction. This new allotment makes a total of $260,000 available for building the generating plant in Pocahontas County, and leaves $158,000 for construction of the first unit of the Franklin County distribution and transmission lines.

Loan contracts

OHIO—Licking Rural Electrification, Inc., Newark, $142,000 to build 144 miles of line, 455 customers in Knox and Locking counties.

TEXAS—City of Bryan, $256,000, 248.5 miles of line, 845 customers in Brazos, Burleson and Robertson counties.

WISCONSIN—Wisconsin Power Cooperative, $150,000 to begin construction on the first unit of a generating plant to be located in Chippewa County to serve six REA-financed projects in nearby counties. The Co-operative will also build approximately 225 miles of transmission lines. When fully built, this plant will probably cost approximately $900,000.

During the month of May among the larger allotments made and the loan contracts executed were the following:

ALLOTMENTS—Michigan, partial allotment $125,000, Cass County. When brought to its full size, this will be one of the largest projects to be financed by REA. Present plans call for a loan of $2,685,000 to build 2,464 miles of line to serve 6,727 customers. South Dakota, $208,000 co-operative to be formed in Lincoln County, 192 miles, 500 customers.

LOAN CONTRACTS—Satilla Rural Electric Membership Corporation, Alma, Georgia,

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ELPECO'S line of U-Bolt Pipe Fittings are strong, adjustable and require no pipe threading.

As a labor-saving device, and giving maximum strength for pipe structures, they fill a definite requirement.

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$425,000, 460 miles of line, 2,045 customers; Thumb Electric Cooperative, Bad Axe, Mich., $2,000,000 to build a generating plant and 1,800 miles of line, to serve 5,500 customers. Southeast Michigan Rural Electric Corporation, Inc., Adrian, Mich., $250,000 to build a generating plant and 120 miles of line to serve 650 customers. Alfalfa County Electric Cooperative, Cherokee, Okla., $310,000, 332 miles of line, 900 customers.

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Recent Legislation

CALIFORNIA—Restrictions on annexation proceedings undertaken by municipal utility districts would be imposed should Gov. Frank F. Merriam sign a bill which has been sent to him by the assembly. This measure would provide that no election proposing the annexation of territory to a district could be held within a year after a similar proposal was defeated, prohibit the annexation of non-contiguous territory unless the district had utility services available to serve the new area and allow annexation elections only upon a petition signed by 25 per cent of the electors. The measure originally provided a two-year waiting period between elections, prohibited absolutely the annexation of non-contiguous territory and required a petition signed by 25 per cent of the district's property owners. It was amended in senate committee.

MICHIGAN—Senate has defeated a bill which would have placed a 3 per cent sales tax on the output of municipally-owned utilities. The tax is now being collected on serviced furnished by private utilities, but the state supreme court, in a test case brought by the city of Lansing and other municipalities owning their power plants, held the original act exempted such systems. A bill has been introduced in the senate which would prohibit public utility strikes unless the strikers gave the Governor and Attorney-General twenty days notice.

MINNESOTA—The Farmer-Labor administration, headed by Gov. Elmer A. Benson, has split with members of the state Legislature, particularly in the Senate, over drastic legislation proposed by the administration forces affecting utility taxes. G. A. Youngquist, former state Attorney-General, estimated that the increase in public utility taxes over other business taxes for a five-year period would be 18.79 per cent. Speakers at the meeting asserted that generally the public utilities tax has been between 10 and 15 per cent higher than any other taxes levied against general business.

NEW JERSEY—Despite the agreement between both houses that only legislation of emergency character could be considered, pressure is being brought to bear on legislative leaders to revive some controversial bills at the current session that were supposed to die with the May 28 adjournment. Among these bills is the Camden municipal power plant measure. The bill having passed in the House, only Senate approval would be necessary.

TEXAS—Gov. James V. Allred has signed the electric co-operative corporation bill, which was passed by the Legislature at its recent regular session. The new law authorizes co-operatives to generate or purchase and to transmit and distribute electric energy and do all other things necessary to carry out their purposes.

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No. 201 N. E. Klein Side Cutting Plier. "Streamlined" for use in confined spaces.

Good workmen demand good tools. In the hands of men who know — everywhere — the pliers are invariably Kleins. Only the keen, hand-honed, perfectly matched cutting knives of Klein Pliers — only the comfortable spring grip in the Klein handles — only the general all around quality that is an inherent part of every Klein Plier can satisfy men whose work demands the best in tools. This, perhaps, explains why Klein Pliers are the standard of quality by which others are judged — why the name Klein has stood for maximum quality, "since 1857."

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- ☐ Specifications on Linemen's Belts and Safety Straps.
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A Business Paper Advertisement Writes Home

Dear Boss:

Six weeks since you've seen me, and am I done in!

You see, "POWER" gets me past doors which put the chill on even our best salesmen. These birds who lay their dough on the line for this paper get their money's worth. And they don't pass up a page.

Everybody here had warned me what a man-eater the Chief Engineer was. So I was shakin' in my covers when he grabbed me. I shook more when he gave me a backhand slap right in the face. But just then he roars at a Shift Engineer standing by, "Well, here she is, Tom! The very power-maker we've been looking for!" And he grins like a gargoyle.

Well, that started it, Boss. On my trip through the power, welding, electrical and millwright departments, everybody gave me a whack and said, "There she is, boys! The one the Chief says we need, and now I can see why." I tried to keep spruced up with all the handling, Boss, but it's no dice — I'm so dog-eared I could bark!

It's the Chief who pays to see me, but he's just the start. I've seen three shift engineers, their assistants, the master millwright, boss welder, chief electrician - and all their crews. And getting to this mob costs you only three quarters of a cent.

I'm writing you from the office file, Boss - it's nice to get a minute's rest. Hold on, though, here comes the Chief. He's hauled me out again. Yep, he's writing you a letter. Well, see you when you swing out this way. And let me tip you off - this job's a pushover now! We're IN.

J. Tellem

P.S. How did my 23,000 twin POWER brothers do on this job, Boss? And you know, POWER is only one of 25 McGraw-Hill business and industrial papers. Why not give us a shot at some of the others?